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ORIGINAL ARTICLES.

GUN-SHOT WOUNDS OF THE SMALL INTESTINES.

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[Address of the Chairman of Section on Surgery and Anatomy.]

MR. PRESIDENT, AND GENTLEMEN OF THE AMERICAN MEDICAL ASSOCIATION:

The subject-matter of the remarks to be presented this morning was suggested to me by an article published in the *British Medical Journal* in 1882, from the pen of "that good man among men, and great man among doctors," J. Marion Sims.

The article in question was an appeal for operative interference in penetrating gun-shot wounds of the abdomen, in lieu of the "expectant treatment" so universally accepted and adopted by the profession, and which, in a few seemingly well authenticated instances, has led to recovery.

The appeal was uttered in behalf of the vast majority on the side of fatality attending these cases, and was based upon the deductions to be drawn from the recoveries following operations for diseases affecting the viscera of the abdomen and pelvis, during which the most terrible injuries have been inflicted upon the contents of these cavities—the peritonæum exposed for hours, as well as brought in contact with all kinds of foreign and usually irritating substances.

It is scarcely necessary for me to affirm in your presence the fact that, with few exceptions, the older writers and surgeons advocate the "expectant treatment" in the management of these injuries, while the younger writers and surgeons favor operations, pinning their faith upon the wonderfully favorable results attending the practice of Listerism, the purest of antiseptic surgical methods.

During the past few months I have instituted and carried out, with the valuable assistance of Mr. J. McDill and Drs. Anthony, Freer and Bolles, a series of experiments for the purpose of ascertaining the results to be obtained by immediate operations after these wounds, with the hope that the relation of the attending circumstances and events would be interesting as well as useful, by adding to the data now in our possession other data, from which may be determined more intelligently the course of action to be adopted when these cases come under our charge for treatment.

No attempt will be made to review the great question of penetrating gun-shot wounds of the abdomen, which would lead me beyond the scope of the paper. Nothing but a fair recital of the history of the experiments, with some application of the conclusions to be drawn therefrom, will be undertaken. With this intent in view, there will be presented to you the accompanying phenomena, the manner of treatment and results of thirty-seven intentional gun-shot wounds of the abdomen, confining my attention entirely to my own observations, and exhibiting to you such specimens as I have been able to preserve, taken from the animals; both of those which died, and of those which were sacrificed, after recovery, to obtain the specimen. Experiments of like nature have been made upon animals by very many surgeons, previous to the application of their convictions of the necessity of certain procedures to relieve disease or the effects of injury in the human body.

No preparation of the animals selected for experiment was made, either as to choice of physical condition or surrounding circumstances, except that they were anæsthetized previous to being hurt. The wounds were produced by the ordinary Smith and Wesson revolver of 22, 32, 38 and 44 caliber, and by the 22 caliber rifle. The shots were given at short range, so the damage done by the bullet fairly represents the injury met with, either in military or civil practice, as the results of shots from the firearms now in use.

At first, no attempt was made to give a definite direction to the course of the bullet, other than that it should perforate the abdominal cavity. The results soon confirmed the fact so well known, that the larger number of patients suffering from such wounds never come into the hands of the surgeon, their injuries proving rapidly fatal.

This ending, we can readily understand, must be a common one, when we bear in mind the construction and nature of the viscera contained in the cavity, especially their great vascularity, having vessels of immense size supplying them with, and carrying away from them, the blood necessary for their nutrition and the performance of their special functions; not to mention the main systemic artery and vein coursing through the cavity in a position rendering them readily liable to perforation, death following speedily.

It was also soon ascertained that a severe perforating and lacerated bullet wound of the viscera, such as of the kidneys, of the spleen, and of the pancreas,

could not apparently be treated successfully in any other way than by an absolute removal of the injured organ; and notwithstanding the reported successful removal of almost every important organ of the abdomen by one surgeon or another, the conclusion was reached that some of these organs must be left *in situ*, in order that the functions of life may be carried on.

Hence we were compelled to exert such control over the course of the missile, as to have it produce a wound of the nature of those likely to come, and actually coming, under the care of the surgeon; so that the injuries became those confined to perforations and injury of the intestinal tube, with occasionally the injury of some of the larger special organs.

It will not be amiss to recall to your minds, very briefly, some of the triumphs of abdominal surgery, and more especially to impress the fact that shot wounds of the cavity and contents present many questions of prime importance which are not met with in, and do not complicate, ordinary operations for disease or injury with any free, external wound.

The removal of the spleen for acute wounds nearly always results in recovery; so also one kidney has been removed successfully, either for disease or injury, often enough to place the operation of nephrectotomy among the list of justifiable undertakings.

Again, wounds of the intestinal tube of all degrees of severity, up to complete division by the resection of portions of the entire caliber thereof, have been successfully treated by surgeons, as is proved by the experimental researches of Dr. Traverse, the eminent Prof. S. D. Gross, Dr. Bell, and others, and confirmed by the experience of many surgeons during operations upon the human being for diseases of these cavities. Still, in each of the examples mentioned, the circumstances were entirely different from what is found present in perforating gun-shot wounds of the abdomen. In the former, the peritoneal cavity was clear of blood and other extraneous substances; the prevention of their entrance entirely under the control of the operator. In the latter, blood in large amounts was always found present; and the peritonæum was smeared with the contents of the intestinal tube, necessitating prolonged efforts to secure a cavity clear of all hurtful substances. Of necessity, the latter cases would be least likely to escape the probabilities and dangers of subsequent inflammation of the serous membrane.

Primary resection of portions of the intestinal tube, or entire removal of separate organs, are operations comparatively easy of performance, and are not necessarily attended with any damage to or exposure of any other portions of the abdominal cavity, outside of the immediate proximity of the site of the operation.

Extravasation and hæmorrhage should be entirely prevented and controlled; and the peritoneal sac can be maintained perfectly clean during the time of, and after, all the procedures required by the operation.

After gun-shot wounds, besides the resection or removal of any special organ required, there is great shock, and prolonged manipulation is necessary to obtain a proper cleanliness.

The recital in detail of each experiment would be tiresome and occupy too much time, so that your attention will be called only to the more important facts and circumstances determined by them.

There will be published with the paper a somewhat extended account of each experiment, from which individual inferences may be drawn. In addition, a short *résumé* of the entire work will be given further along.

First comes the question of hæmorrhage and damage to blood-vessels, as this is primarily the most common and certain cause of death, and demands the surgeon's first attention. In its excessive amount, occurring rapidly and suddenly, is to be found the explanation of the cases which are immediately fatal. This result will surely happen when the largest arterial trunks are severed by the bullet; further, its copiousness and persistency of flow, even when none but very small blood-vessels are divided, involve a matter of serious concern, if not a fatal issue, either from the amount of blood lost, or in predisposing to septic processes from blood decomposition.

There is a remarkable persistency in the flow of blood following the severance of vessels in the abdominal cavity, perhaps dependent upon the laxity of the tissues through which these vessels course, the absence of pressure from surrounding soft parts, and the lack of the peculiar influence of the atmosphere, either from its weight or clot-producing power.

When the abdomen is opened immediately after the transit of a bullet, its cavity is found to contain a large amount of blood, the quantity, of course, being in proportion to the size of the vessels wounded, but always a disproportionately large amount, no matter what their caliber; further, the flow is still going on from vessels of all sizes. There seems to be slight disposition to the formation of an obstructive clot in the mouths of the smaller ones, and slow retraction or contraction of the walls of the larger.

Bleeding stops only when the heart ceases to beat in a faint from excessive loss, or when the amount of blood is so large that by its bulk, and weight, and distension of the abdominal walls, it makes pressure sufficient to occlude the open vessels.

The conditions are very quickly altered after air is admitted through the abdominal section. Clots rapidly seal up the smallest vessel; the smaller arteries spurt less forcibly and soon cease beating; the larger ones contract and retract, just as occurs in the wounds of soft parts in other regions of the body. This is in accordance with, and corroborative of the experience in hæmorrhages occurring in abdominal surgery in the human being. Few of us have failed to see cases like this: a patient dies suddenly, with all the symptoms of acute prostrating hæmorrhage; post-mortem examination shows the abdominal cavity filled with blood; the blood is carefully cleared away in the search for the source whence it came; and when this is found, it is a matter of astonishment that such a vast amount of blood could come from so small a vessel. Perhaps it is a small vein of the ovarian venous plexus, or a minute vessel in the thin-walled sac of an extra-uterine fœtation, or the partially closed vessels in the shrunken stump of a

recently removed ovarian or other tumor, or some recently divided adhesions, all of them vessels which, in any other part of the body, would be no item of concern to the surgeon, or need any of his special care to prevent bleeding from them.

The lesson taught by these facts is of imperative importance in all operations upon these cavities; and even if mastered, loses nothing by reiteration. Excessive hæmorrhage being certainly the principal cause of speedy death in severe gun-shot wounds in this region of the body, where evidences of its presence are plainly exhibited, there can be no hope whatever of saving the lives of any of the wounded except by immediate abdominal section. This alone, by admitting air quickly, staunches the fast flowing current, and gives time for the application of the ordinary rules of surgery for the prevention of hæmorrhage.

In order to be safe from subsequent trouble, every divided blood-vessel must receive the surgeon's attention, occluding clots must be thoroughly sponged away, and in their stead must be placed the ligature or the sear of the actual cautery. If left without this restraint, and the abdominal opening be closed, the same conditions are restored as existed previous to the section; and as reaction comes on, bleeding will surely recur, and in large amount, leading to death from this cause alone, or furnishing a frequent source of septicæmia.

This fact again is corroborative of the experience of ovariotomists, the most successful being those who take the greatest pains to staunch all bleeding before closing the abdomen.

Following a resection of three or four inches of bowel and a ligation of two large subdivisions of the mesenteric artery wounded by the bullet, there occurred a mortification of several inches of the entire intestine above the site of resection. The mortified part corresponded with the distribution of the arteries wounded and ligated. This assuredly was an important fact to know, if at all likely to occur as the result of wounds of these arterial branches; even its accidental occurrence is a circumstance to be remembered. Its occurrence would surely add largely to the gravity of the cases in which it happened, probably necessitating a resection of a portion of the intestine corresponding to the area of distribution of the wounded vessel. The great freedom of anastamosis between the mesenteric arteries rather argues against their wounds being followed by any such hazardous result; still, the case recorded above required explanation. Two experiments were performed in order to determine whether destruction of the arteries alone was sufficient to lead to such mortification.

Both demonstrated that a closure of two or three of the largest subdivisions of the main mesenteric vessel was not in itself sufficient to produce death of the portion of intestine supplied by them. The experiments were as follows: an animal was anæsthetized, and the abdomen opened. A sufficient length of bowel was drawn through the opening to allow of the ligation of two large sets of vessels adjoining each, the ligatures including vein and artery. The parts were returned to the abdomen and the latter closed. At the end of thirty-six hours the wound was reopened. No very noticeable change was found in the intestine; pulsation had returned in the ligated vessels beyond the ligature. The external wound was again closed. The animal recovered in a few days so as to be as lively as ever.

A second animal was etherized, and a ventral section made. Three large vessels were ligated (veins and arteries), before their division into any branches. These three vessels lay parallel with each other. A ligature was also thrown around the anastomosing branch near the intestine which connected with a fourth larger vessel. There followed immediately very marked whitening of the bowel. The parts were returned and the wounds closed. The animal recovered promptly from the effects of the ether and the immediate effects of the operation.

It remained quite well for six days, when it grew ill. The wounds were reopened. Pulsation had returned beyond the ligature. There was no sloughing or mortification of the intestine. It was congested slightly and seemed paralyzed, and was of wider caliber opposite the distribution of the ligated vessels; this was the only change. There was a great deal of very offensive matter in the peritoneal sac, and notwithstanding the high grade of inflammation, there was no adhesion of intestinal folds except at one point. Here there was found a perforation of the intestine. Out of the opening there protruded a piece of wood which, upon being pulled out from the cavity of the intestine, was found to be four inches long, and connected with a large mass of twine. This had evidently been swallowed by the animal, and had gotten along safely enough until it reached the inactive portion of the tube corresponding to the seat of operation, where it was forced through the tube by the strong contractions behind it. Unfortunately, the animal was killed by the ether during the examination. Aside from this accident, the animal had a good chance of recovery.

The complication of a complete resection of the bowel, with a ligation of two or more vessels, is the only explanation to be given of the case where mortification occurred. The experiments prove that such result does not follow simple closure of the vessels by ligation.

The second item to be considered refers to the course of the bullet and the character of the damage done by it. Nothing can possibly be more uncertain and erratic than the track of the missile through the body. A contracting muscular fiber, an edge of fascia, the elasticity of the skin, a surface of bone, or a distended knuckle of intestine, each and all of these at times present obstruction sufficient to divert it from the direct line of its flight. It is certainly astonishing what very extensive and severe lacerations of the intestine are produced by so small a bullet as one of caliber No. 22, Fig. 1; the entire circumference of the bowel at some points being mangled beyond recognition; again, it is equally surprising how minute are the perforations made by the large No. 44, Fig. 2. As a rule, the larger the calibre of the bullet the larger the wound.

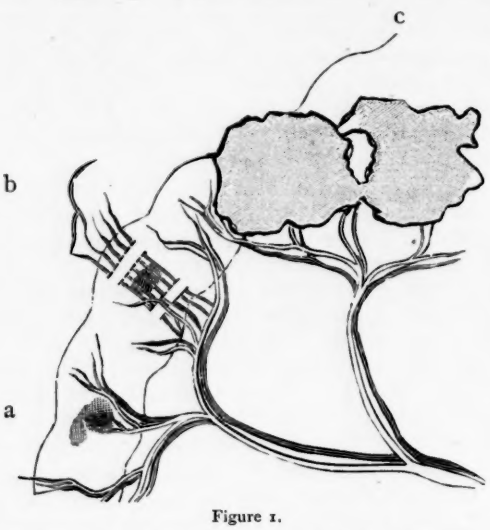

Figure 1.

An estimate of the direction of transit, based upon the points of entrance and exit, is purely conjectural, and furnishes no standard whatever by which we may judge of any supposed injury to any organs known to lie in such course. In one experiment, the bullet made four openings through the abdominal walls, and did no damage other than contusion of two knuckles of the small intestine and gouging the serous membrane.

The animal had a remarkably deep furrow along the course of the "linea alba." The bullet entered the right side of the abdomen obliquely, two inches from the mid-line, perforated its walls, and coursing to the left, furrowed the peritonæum in its passage; was evidently deflected outwards, immediately before reaching the linea alba, by a knuckle of intestine, which it contused slightly.

Here it made its first exit through the walls, passed to the left side of the mid-line, again perforated the abdominal walls, and, furrowing the peritonæum upon the left side, finally made its second exit through the abdominal walls three inches to the left of the linea alba. Near its place of final exit, a second knuckle of intestine was found badly contused. The contusion was so severe and extensive that it was thought best to resect a length of one inch. The animal recovered.

In a second instance, the bullet entered the cavity about two inches to the right of the linea alba, on a line with the umbilicus, with a direction upwards and to the left side. It made its exit nine inches to the left of the mid-line, and just at the lower edges of the last rib. On opening the abdomen the stomach was found greatly distended, entirely concealing the other viscera from view, and presented two large perforations in its walls about two inches apart, from which some blood, mucus, and food were found running into the peritoneal sac. The wound to the right, in the stomach walls, was the smaller, and situated directly opposite the entrance perforation in the abdominal wall, having the same direction. The wound to the left in the stomach walls (two inches to the left) was the larger, very ragged, and had evidently been made by the bullet deflected forward at its first entrance into the stomach. After leaving the stomach the bullet impinged upon the inside of the abdominal walls just to the left of the mid-line, and then, instead of perforating them at that point, was again deflected upwards and to the left, merely furrowing the peritonæum along the remainder of its course to the point of exit mentioned. The wounds of the stomach were inverted, as it were, into the cavity of that organ, by bringing its peritoneal surfaces surrounding the wounds in contact with each other by means of the continued catgut suture. The abdomen was carefully cleansed of blood, etc., and the wounds in the walls closed in the ordinary way. The animal speedily recovered from the injury, without any uncomfortable symptoms. During recovery from the effects of the ether, the animal vomited considerable quantities of blood, giving an additional evidence of the perforation of the stomach.

There were two cases where the bullets perforated the abdominal walls, and in their transit did no injuries to the viscera, in which the points of entrance and exit were five and six inches apart. In each instance the only damage done was a furrowing and laceration of the peritonæum along their entire courses, the blood from the track of injury falling into the abdominal cavity. In one experiment, the bullet failed to penetrate the abdominal walls and was subsequently dissected from between the muscles. On opening the cavity, quite a rent was found in the spleen opposite to the seat of external bullet wound, from which blood was freely flowing. There was neither abrasion nor perforation of the peritonæum. This case may suggest the probable cause of death in some fatal cases from non-perforating wounds. The laceration was evidently caused by concussion alone.

Other instances might be cited to illustrate the exceedingly great uncertainty as to the course taken by the bullet, and as to the organs probably impaired. They would also confirm the possibility of perforations of the walls without accompanying injury to the contents of the abdomen. Still, no instance was shown of failure to produce a wound thereof when the bullet's course lay among the intestines. Their safety followed deviation by glancing.

The wounds of the intestine may be many in number and situated very near to each other (Fig. 2) so

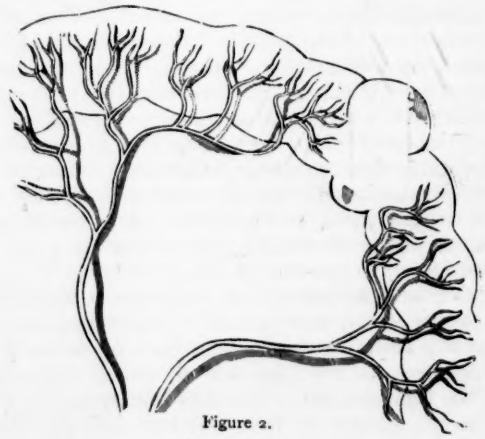

Figure 2.

that one resection including all the openings will constitute the only operation that furnishes relief.

Again, the openings may be few in number and widely removed from each other; and if each wound is large, and the damage to the tube extensive, such as is usually produced by a 32, 38 or 44 caliber bullet, three or four resections are necessary. The latter are the most difficult cases to manage and most fatal in their results. The position of the points of entrance and exit of the bullet in the intestine is subject to immense variety, even in simple cases. It may involve only the top of a knuckle of intestine, merely opening the cavity thereof. The points may be so near each other that only a half inch or less of intestinal wall separates them from each other. (Fig. 1, a.) The bullet may merely cut off the mesenteric junction opening into the cavity more or less freely. The intestine is often perforated transversely near the middle, or longitudinally; in the latter case the bullet, entering at one point, courses along in the cavity of the tube for some inches, and then makes its exit.

All of these varieties depend upon the situation of the intestinal folds with reference to each other at the time of the transit of the bullet. One case showed 10 complete perforations in 18 inches of length of the ileum. Fig. 3.

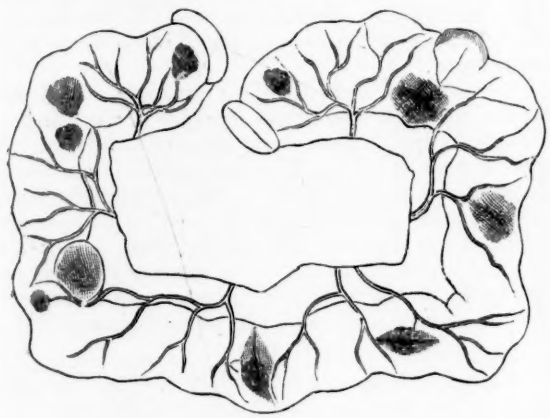

Figure 3.

Extravasation of the contents of the tube was present in every instance where there existed the slightest degree of perforation. These contents were forced out into the peritoneal cavity, or on to the surface of the intestines, if the wound was large, by the bullet itself, and the normal tonic contractions of the bowels; and, if small, perhaps by the latter alone. This facility of extravasation agrees with my experience in wounds of the intestine in the human being. I have personal knowledge of two instances in which the medium-sized aspirator needle was employed to relieve tympanitic distension of the tube, with success so far as getting rid of the gas was concerned, and giving great temporary comfort to the patient. Death ensued from the disease. Post-mortem examination in each case demonstrated the presence of fæcal extravasation at the seat of the needle puncture. It would not be an arduous task to collate instances of this accident in the practice of others, where this plan has been adopted. It is difficult to understand how any other result could follow a perforation, if there be contents at the seat of the puncture, when we remember how strong and constant is the action of the circular muscular fiber. It is stated that the protrusion or eversion of the mucous coat, which ensues very rapidly after complete division of the walls, acts as an immediate stopper to wounds of small size, say one-eighth of an inch in diameter. This may be true in incised wounds, but it was not shown to exist in a single one of the several hundred perforations coming under my inspection as made by the bullet. The latter tears away and lacerates the parts through which it passes, and perhaps paralyzes the muscular fibers in its immediate neighborhood, but whatever the cause, there was no instance in which the eversion of the mucous membrane was sufficient to prevent extravasation.

Recognizing the very deleterious influence of this material upon the peritoneal membrane, this fact of the great certainty of extravasation adds another point to the argument in favor of abdominal section in these cases, as furnishing the only means by which this source of trouble can be absolutely eliminated.

As part of the extravasated material from the wounds of the intestine, it was an exceedingly common thing to find intestinal worms of all kinds, and in large numbers, protruding from the rents or free in the serous cavity.

In the treatment adopted during these experimentations, it was found necessary to make an extensive external incision, freely exposing the abdominal cavity, in order that all the viscera might be thoroughly and carefully examined, and every wound brought within reach. In a majority of instances the median line gave space enough, in two the bleeding vessels could not be reached without a lateral prolongation toward the flanks.

There was no reason to suppose that the extent of the incision added very much, if at all, to the gravity of the operation. After opening the abdomen, the intestines were all turned out, critically examined for perforation or contusion, the situation of these fixed, and the hæmorrhage therefrom controlled by means of the snap forceps, after which wounds of special organs were sought for. If the substance of the spleen or the kidney was found perforated, the organ was immediately removed after ligating its blood-vessels, the stump being returned to the abdomen. If slight lacerations only at some point on the surface had been produced, these were closed by bringing peritoneal surfaces of the organ over the wound by means of the continued suture.

The peritoneal sac was then carefully and thoroughly cleared of blood and other extraneous substances by repeated sponging or irrigation. The intestines, which during this process had been protected by being enveloped in towels wrung out of warm water, were now cleanly sponged, while all unwounded portions were returned to the abdomen.

It seems to be of little consequence whether or not the intestines be returned to the cavity in any definite order — in fact, it is doubtful whether they are ever returned precisely to the same positions they originally occupied before being disarranged during

the operation. Still, some care must be used in order to avoid the accident which happened in one experiment. After the divided ends of the intestine had been united, it was found that during the manipulation one of the ends had in some way been passed through an opening in the divided mesentery, so as to produce a figure of eight convolution in the tube. It was left in this shape. The animal recovered, and I have the specimen with me to demonstrate the perfectness and security of the union in the intestine at the place of reunion. The animal was sacrificed to secure the specimen six weeks after the operation. The abdominal cavity was quite free from evidences of inflammation, except where the misplaced folds lay in contact with each other. At this point slight peritoneal adhesion had formed between them.

Where several wounds occurred rather close together, severe enough to destroy a considerable portion of the integrity of the bowel, one resection was made to include all of them, even when the length of intestine removed measured ten inches or more. Where the points of injury were widely separated from each other and extensive damage done at each point, several resections of a length of the tube just sufficient to include the injured portions were made.

In the former case, in which several inches, or more, of the tube were taken away, the mesentery was ligated as close as practicable to the intestine (Fig. 3), in sections corresponding to the number of blood-vessels going through it to the resected portions. The mesentery was then divided close to the intestinal wall. After this, the tube itself was separated, and the wounded portion removed. One artery, always needing ligation, was found in the divided ends at the point of junction of the mesentery with the intestine. Before the final division of the intestine, its contents were pushed back out of the way, compression exercised upon its walls by a pair of forceps or a temporary ligature, in order to prevent extravasation of its contents through the divided ends. The mark of constriction made by the forceps or ligature, used to close the lumen of the bowel, was to be plainly seen several days after the operation. The safest compression can be made by an assistant's fingers. Results soon demonstrated the paramount necessity of carefully selecting the place for final division of the intestine, in order to avoid sloughing of the edges approximated together, the results being best in those cases where the division was made close to the point at which any given mesenteric artery approached nearest to the intestine, as compared with those where the cut was made in the intervals between any two branches of these vessels, and this was seemingly dependent on the better supply of blood belonging to the former cases. Immediately after division of the intestine, there followed an instantaneous, regular and considerable contraction of the caliber of the tube (Fig. 4, a), close up to the divided edge, caused by the action of the circular muscular fiber. The diameter was often diminished more than half by this contraction. This persisted for a time, but was soon followed by an eversion of the mucous membrane, which rolled out and over the constricted portion in a remarkable manner. (See Fig. 4, a, b and c.)

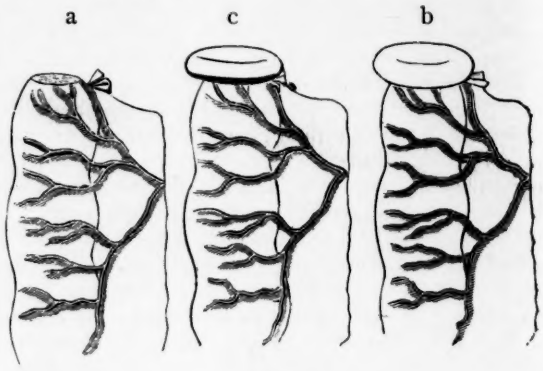

Figure 4.

This protrusion of the mucous membrane forms a serious obstacle to easy and close approximation of the ends of the bowel in the efforts to bring them together by sutures; and, when turned into the bowel during such procedure, diminishes its caliber considerably, although it was not demonstrated that the obstruction was ever sufficient to prevent the passage of the intestinal contents. Several efforts were made to get rid of it, and overcome the seeming delay caused by its presence, but all these were finally abandoned.

It was pared away with the scissors; it was dissected up from the other coats for a quarter inch from the edges, but the conclusion was finally reached that instead of being a harm, its presence was useful in giving support, protection, and perhaps vascularity to the freshly sutured edges; at least, in all instances where it was removed, the stitches were found torn out and union defeated; in no instance where it was left entire did there fail to be union in some part, and no sutures gave way when properly applied.

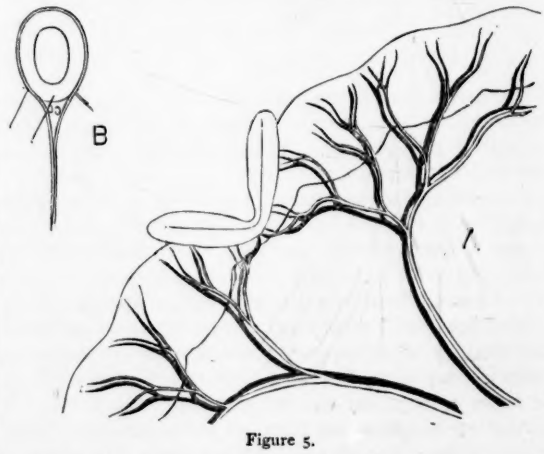

Figure 5.

In all instances where a perforation was severe enough to require a resection of the wounded part, it was found advantageous to leave, if possible, a strip of the bowel near the mesenteric junction (Fig. 5 A), taking out the wounded portion by means of a "V"-

shaped incision. The part left acted as a support to the wound, avoided division of the blood-vessels at this point, opposed the action of the longitudinal fibers, and in no instance in which this plan was adopted was there any appearance of separation of the wound or any displacement of stitches. In perforations through the stomach, the wound did well after drawing the peritoneal surfaces some distance from the edges thereof, over it, by means of the continued suture, thus converting it into a linear wound (Fig. 6 A). The same plan was adopted with success in abrasion and small perforations in the small intestines. (Fig. 6 B.)

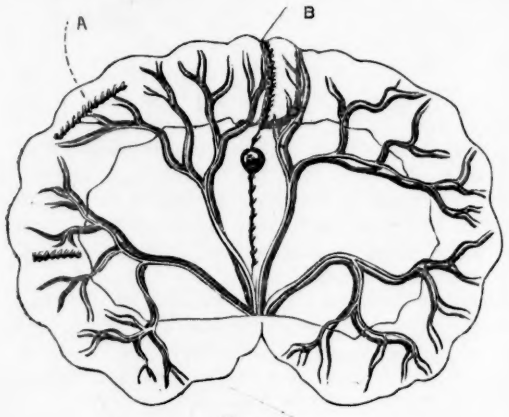

Figure 6.

This way of treating the bullet openings in the bowel is susceptible of much wider application than would appear possible at the first glance. I am quite well satisfied that it will safely take the place of excision in not a few cases of quite severe injury. The torn edges of the wound can be turned in, and peritoneal surfaces fastened together, even in large wounds, with perfect confidence in the result of safe and secure adhesion following.

It seems probable that by far the greater number of successful cases will follow a single resection, even if that include a number of perforations, and involves eight or ten inches of bowel, in comparison with those cases where several excisions are made of wounded portions widely separated.

Perforations passing through the mesenteric surface of the intestine were found the most difficult to treat, and even if slight, seemed always to require a complete excision. A partial excision of this surface of the bowel resulted in an acute-angled elbow which never did well.

The point of attachment of the mesentery with the bowel, will usually be found the most troublesome to manage, in applying the sutures in restoring a complete division. (Fig. 5, B.) It is quite difficult to so place the sutures as to secure a perfect reinversion of the mucous membrane, to bring serous surfaces fairly in contact with each other, and to get a sound junction. The difficulty arises apparently from the manner in which the folds of peritonæum separate from each other before passing on to invest the bowel, leaving a little triangular interval filled with loose connective tissues, fat and blood-vessels. Now, if the suture fails to include the muscular coats of the intestine as well as the peritonæum at this point, the junction will surely give way and extravasation result. To make this point secure, the greatest possible care must be taken in placing at least three sutures, this number being usually quite enough to include the troublesome area, and these should always be the first sutures applied. In placing the remaining sutures to complete the junction after placing the three sutures mentioned, at the mesenteric surface, it assists materially in the ease of application, saves time, and especially avoids trouble from the everted mucous membrane, to apply one at the most convex surface, and then one half way down, on each lateral surface. After this is done, the remainder can be introduced easily and rapidly. If introduced in a regular series, one after the other, all the way around, it is a very slow process; the mucous membrane is always in the way, the needle openings in the intestines are apt to be uneven, and it is altogether the poorest plan of proceeding. The advantages mentioned as gained, by taking the course suggested, are certainly all of them items of importance, and have some bearing on the result. At best, these procedures will be found very prolonged and tedious. The material used by me for sutures was silk and catgut — the latter for the continued, the former for the interrupted ligatures. No. 1 catgut; No. 2 silk. The needles were the full curved round needle, or ordinary straight sewing needle; the latter is the best. The sutures were introduced about the third of an inch from the divided edges, made to include the peritoneal and muscular coats, and brought out just free of the edge on one side, and were then reintroduced close to the edge, and made to include about the same amount and kind of tissue on the other side, being very sure not to allow the needle to pass into the intestinal cavity. Howse, of London, proved conclusively in his cases of gastrotomy, that the fact of entrance of the needle into the cavity of the tube, carrying the thread with it, made the difference between success and failure, cases dying from peritonitis and extravasation when the entry occurred, and recovery following when the thread included only the peritonæum and muscular coats.

Again, the everted tissue should be turned in before introducing the needle, so that it will pass through the rim of constriction. If entered too far away from the divided edge, too much tissue is turned into the intestine. When the mucous membrane was turned in, and the suture tightened, two broad surfaces of peritonæum were brought in contact. This you will recognize as Lembert's suture (Fig. 6, B), with one change. Lembert directs that only one and one-half line in width of tissue should be taken up by the suture. This amount of tissue will do very well in the closure of small slits, for which it was intended, and to which it was applied; but complete resection needs a much firmer hold to withstand the strain of peristaltic movements. *The fact is that it makes no difference whatever what kind of suture is used, so that the principle of positively securing the application of two broad surfaces of peritonæum in contact with each other is certainly carried out. Jobert's,*

Gely's and Czerny's double row of sutures were all given a fair trial, but none of them resulted as well as this. It never failed to be followed by good union when properly applied, with peritoneal surfaces brought together around the entire circumference of the intestine.

The greatest number of mishaps followed drawing the sutures too tightly, which, if done, leads to death of the applied edges, and, of course, to failure. They must be drawn only sufficiently close to bring the surfaces fairly in contact, the subsequent swelling from obstructed circulation will hold the surfaces firmly together until glued to each other by the rapidly forming adhesive material.

The interval left by the incurving of the edges of the bowel, immediately after the completion of the operation, was found entirely obliterated, and the sutures covered up by effused lymph at the end of twenty-four hours. In one or two instances where very small openings had been made in the bowel, they were occluded by passing a suture around the perforation, a short distance from its margin, pushing the wound into the cavity of the intestine, and then by tightening the suture the peritonæum was drawn together over it; a very satisfactory plan of procedure where circumstances will permit its application.

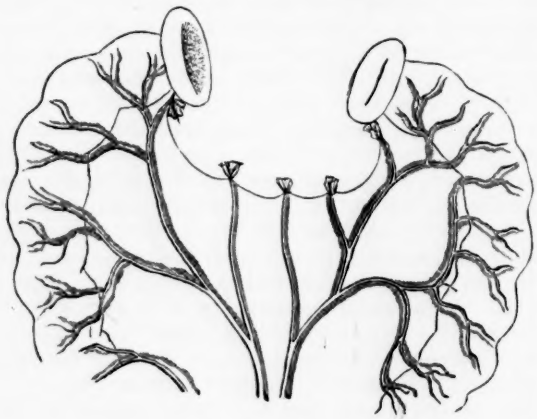

Figure 7.

The question of the proper disposition to be made of the divided mesentery, after removal of some length of the intestine, is an important one to decide. No plan adopted proved entirely satisfactory. Previous to separation it was ligated in sections (see Fig. 7); the part beyond ligature is apt to mortify and thus prove a focus for fatal inflammation. The tissue of the mesenteric membrane is not very vascular, and the vitality of the distal portion of the stump is seemingly best provided for by causing it to adhere to surrounding vascular parts.

In some cases the stumps were left free in the abdominal cavity; these all did badly, each showing mortification. In others the different sections were all included in one suture and then stitched to the bowel at the seat of operation, making as nearly as possible a continuous surface of mesentery.

These did much better, there being few instances of sloughing. When sloughing occurred, it seemed to be dependent upon and follow a too tightly fastened ligature. This method above mentioned of treating the divided mesentery, is useful in another way; it gives support to the bowel at the point of resection, maintains the intestine in proper position by preventing bending, and also leaves fewer raw surfaces free in the serous sac. This last, a condition acknowledged to be the frequent source of serious trouble from faulty adhesions to surrounding organs, and from furnishing points from which septic absorption takes place.

A plan of dividing and treating the intestine and mesentery has been suggested to me as a possible improvement on those already noticed. This is to make the separation through the intestinal walls three-eighths of an inch on either side of the mesenteric attachment, tear away the mucous lining of the retained strip of bowel, and draw the peritoneal surfaces thereof together by the continued stitch. This would avoid division of the blood-vessels going to the bowel, do away with the necessity of using ligatures, and leave no raw surfaces free in the abdominal cavity. The opening formed by the folding together where the bowel-ends are united, should be closed by the continued suture.

Bleeding from slight lacerations of the spleen, kidney or liver, can be controlled with actual cautery lightly applied, perhaps the very best method to adopt. If the wound is a complete perforation of the body of the organ, the hæmorrhage is very great, rendering extirpation of the entire organ apparently the only sure way of surmounting the difficulty.

Quite frequently the entire mass of the greater omentum seemed to require removal. The bullet in transit not only perforated it here and there, but passed along between its folds as well, leaving injured tissue and blood-clots of considerable size in its track. These clots disseminated themselves in the meshes in such a way as to entirely prevent their removal without tearing the tissue to shreds. When this condition was present in any degree the mass was amputated, after ligation, in sections. In a few instances these stumps gave rise to trouble, either from recurring hæmorrhage or mortification of the distal end.

In the after treatment it was often necessary to administer morphia to secure quiet. Very careful attention must be paid to the amount and kind of food given for some time after apparent recovery. One experiment resulted in failure after the lapse of three weeks from date of operation. The animal was lively, running about as freely as ever, all the functions normal, and the external wounds all healed, when it suddenly sickened and died, having tetanus accompanying rupture of the intestine, several inches above the seat of resection. Post-mortem examination showed masses of food and grit and greasy cloth, occluding the intestine, and distending it so enormously that rupture was produced; the tube at the seat of operation was patulous and nearly of usual size. This animal was lost solely through neglect in the matter of feeding. Milk alone was given in all other cases for some weeks after operation. Certainly this is a matter of great importance,

and suggestive of the proper care to be given after all such operations. Extreme emaciation occurs during the first week following the operation, and, if there is shown any likelihood of recovery, there follows a voracious appetite, which should be very sparingly gratified.

The circumstances under which these experiments were done, were such, that it was absolutely impossible to carry out full antiseptic appliances. The external incision was treated with iodoform and oakum or absorbent cotton, and with two exceptions healed by first intention.

The bullet wounds through the abdominal walls were not probed nor disturbed in any way. Occasionally, when large and much contused, iodoform was poured on them. In only two instances did they suppurate or give rise to any trouble whatever, crusting over and healing rapidly. This result clearly enforces the rule of not disturbing the track of a bullet through the soft parts, unless the most urgent reasons call for interference. The damage of a serious nature is not in the abdominal walls, but in the cavity; the nature of it can be better ascertained and the most satisfactory treatment adopted, after section through the linea alba, rather than by enlargement of the wound of exit or entrance, if any surgical interference be instituted.

In gunshot wounds of any part of the body, it is not the injured muscular tissue or fascia that causes grave concern, but the torn arterial trunk, or severed nerve, or fractured bone made by the missile, and here, too, incisions out of the course of the bullet track often furnish the best exposure of the parts for manipulation.

None of the wounds of entrance were perpendicular to the surface of the abdomen. All were more or less obliquely directed through the component tissues of the walls, so that they were valve-like in character and tended to close spontaneously. None of the cases presented any extravasation of the contents of the intestines through the external wounds, notwithstanding the lacerations of the tube were often very extensive, and considerable quantities of fæcal matter were found in the peritoneal sac. The conclusion naturally follows, that the discharge of such matters, through the external openings, is not of frequent occurrence after the wounds under consideration. The absence thereof is far from being proof of the non-occurrence of perforation of the intestine.

It can scarcely be expected that extravasation through the wounds in the abdomen will often happen as an immediate occurrence. This is most likely to occur, if present at all, several days after the injury, following adhesion of the bowel to surrounding parts, and the accumulation of considerable quantity of matter.

There is no reason to suppose that interference with the adhesions to be met with in operations, done some time after the injury, would be followed by any worse consequences than that which follows their disruption during the performance of operations for ovarian or other tumors. The hazard supposed to attend their severance is certainly exaggerated. With a clean cavity, they will do equally well in all cases.

These experiments have not developed any data which will aid in the positive diagnosis of the severity, or extent, or kind of injury done to the viscera, or render such diagnosis less difficult than heretofore, previous to abdominal section.

They go a step in advance of this by supporting the assertion that it is absolutely useless to expect immunity from perforations of the intestines when the bullet has traversed the cavity. It seems, and is infinitely more reasonable to subject a patient to the slight risk of an abdominal section, showing unwounded intestines, than to allow him to pass through the fearfully deadly peril of wounded intestines unrelieved, on the barren supposition that they may have escaped injury.

Some uncertainty as to its necessity is likely to arise, except in those cases showing extravasation of the contents of the bowels, or those where the free loss of blood, as indicated by the usual symptoms accompanying such accident, calls for aid. When doubt exists, and a critical condition of the patient argues severity of lesion, abdominal section surely seems to promise relief that can come in no other way. Exploratory incision of the abdominal walls has been done so often, and with so little hazard, as to entitle it to be classed as a procedure in itself almost destitute of danger. Such a conclusion is certainly supported by the results developed during these trials. The rule was, no trouble whatsoever from this incision.

No deduction can more justly or positively follow, as the result of these experiments, than that an incision *de novo*, through the linea alba, is the best method of procedure in the treatment of the class of wounds under consideration; a plan far preferable to enlarging either of the openings made by the bullet. It at once gives command over the entire cavity; therefore any lesion likely to result in harm is far less liable to be overlooked; it is the least vascular part of the walls; incisions thereof are more easily and perfectly co-aptated than elsewhere, heal readily and soundly, and as a consequence, the oncoming cicatrix is less likely to be followed by ventral herniæ.

Thirty-nine (39) animals were used in these experiments, exclusive of those dying from the effects of the anæsthetic. Two of the thirty-nine were used to demonstrate the effects of closure of the main branches of the mesenteric artery upon the nutrition of the intestines. Of the remaining thirty-seven (37), three cases died immediately after the shot or from the effects of profuse hæmorrhage; one having a division of the aorta just below the mesenteric artery; the second had a large laceration of the kidney, with a wound of the renal artery; the third, a laceration of both kidney and spleen. One case, No. 4, had tetanus three weeks after operation, and is given a special position, simply owing to the presence of this condition as a complication in the case. The post-mortem examination, as already mentioned, developed other conditions which would have caused death, and which were no doubt the cause of the tetanic

convulsions. Twelve of the remaining cases died inside of twenty-four hours, either from severe primary or recurring hæmorrhage, and the effects of the very extensive character of the wounds. Two out of this twelve (12) were cases requiring removal of the pregnant uterus, accompanied with many perforations of the bowel; death in both occurred from secondary hæmorrhage from uterine stumps—the ligature having slipped. Three (3) more had slight lacerations of the spleen and numerous perforations of the intestine. The spleen was removed and several inches of the tube excised in each case. In three (3) others, from twelve to twenty inches of the bowel was excised, and many arterial trunks severed. One of the twelve (12) had rapid mortification of five or six inches of the entire caliber of the bowel, apparently dependent upon the division of two large mesenteric arteries by the bullet, and also the resection of six inches of the intestine. The remaining three (3) of the number dying inside of twenty-four hours, are classified as having died of shock. On all of them the damage done by the missile was of excessive severity. The bullet was of large size, (38 or 44 caliber) and the fire-arms possessing great penetrating and lacerating power. There was not manifested in any case any recognizable evidence of shock aside from that following great loss of blood. The transit of the bullet made no noticeable impressions upon the pulse or respiration. In every instance where signs of severe prostration became manifest, through change in respiration or weakening of pulse, there was found profuse hæmorrhage to account for such condition. I am inclined to infer that the cases are exceptional indeed, in which purely nervous shock will give rise to symptoms severe enough to mislead one to perform an unnecessary ventral section; rather, when severe constitutional manifestations follow the passage of a bullet through the abdominal cavity, good cause for them will be found, as soon as the cavity is opened, in wounded viscera or blood-vessels, and this course will often be the only possible way of either actually saving life or even prolonging it. None of these twelve cases could possibly have lived longer than twenty-four hours after the injury received. Most of them would have died much sooner without the control of hæmorrhage, alone made possible by the opening.

Two cases of the series were subjected to the expectant treatment. These cases were chosen because their injuries did not seem very severe; the hæmorrhage was not great, and the prostration not extreme. Both died; the first in one day; the other lived five days. Post-mortem examination showed extensive extravasation of the contents of the bowel and septic peritonitis.

In one case an attempt was made to establish an artificial anus. The wounded intestine was resected, and the ends fastened to the edges of the abdominal incision. The animal died of septic peritonitis in three days. This trial was made early in the experimentation, before any definite plan of procedure had been settled upon. This is the only experiment that has given rise to any regret, for I feel satisfied that, with a fair junction of the bowel and a clean abdomen, the animal would have been saved.

Eighteen of the thirty-seven (37) have thus far been accounted for; of the remaining nineteen (19) ten (10) died, and nine (9) recovered.

The ten fatal cases lived from three days to three weeks. Peritonitis from one cause or another seemed to be the precursor of death. In six of them, mortification of the ligated stumps of the divided mesentery, together with mortification of the edges of the recently united bowel, were present. In the one that lived three weeks, death was the result of intestinal obstruction, caused by the adhesion of a fold of the intestine to the stump of mesentery left free in the cavity. An acute flexure was produced at the point, against which the contents of the bowel had accumulated in large quantity. A rupture was found above this mass, through which extravasation had taken place. The inflammation was so intense that everything was matted together, and the specimen so horribly offensive it could not be preserved. There was no separation at the point of operation on the bowel; it was thicker here than elsewhere; but full distension with water was allowed without leaking. All of these cases demonstrate conclusively the necessity of great care in the manner of dealing with the divided mesentery, and in the application of the sutures which bring the separated bowel-ends together. The remaining four furnished evidence of separation of the recently united parts of the intestine at the mesenteric junction. In all of them the thread failed to include the muscular and fibrous coat of the bowel, holding only the peritonæum. The result was extravasation, and death followed.

It may be a matter of surprise to you that the percentage of successful cases presented is so small—nine out of nineteen—so few out of so many. To me, knowing well the extremely adverse circumstances under which these experiments were performed, it is a matter of astonishment to have so many recoveries included in so few cases. It is suggestive to remember that all the recoveries followed the use of Lembert's method of bringing the peritoneal surfaces together, while in many of the failures, trials were made of other methods. Full six weeks have gone since the last case followed by recovery was subjected to operation. The first favorable case was treated four months ago. None of the animals present evidence of being other than in their usual health. The longest resection of intestine among the recoveries measured over six (6) inches and included four (4) perforations.

It is scarcely possible to do work of any kind under more disadvantageous surroundings than accompanied the performance of these experiments. The operative work was carried on, and the animals kept in the prosector's room of a medical college during the winter season, in the midst of the odds and ends and bad hygienic conditions of such a place. No better accommodations could be secured. The labor has been purely one of experimental inquiry, and not a striving after recoveries, implying a choice selection of attending circumstances and special preparations to that end; therefore I judge it proper

and fair to claim the results as satisfactory. These results certainly indicate that a better showing is likely to follow where more satisfactory control can be had over both patients and surroundings, than was present during these examinations.

They clearly demonstrate that a hopeful expectation of recovery may be entertained after operation, and suggest the nature of the injuries produced, what accident to avoid, and what treatment to adopt.

My confidence in coming before you with no better record is assured, when I remember that all of you are well aware of the great mortality of these injuries, under all circumstances. It must be large, surely, when Dr. Otis, in the surgical history of the war, says the authenticated cases of recovery can be counted on the fingers of one hand. It can not be said that operative interference in these cases has as yet an established position. Still, perhaps Dr. J. Marion Sims looked with prophetic eyes upon the future, when he closed the article already referred to with the following words: "I have the deepest conviction that there is no more danger of a man's dying of a gunshot or other wound of the peritoneal cavity, properly treated, than there is of a woman's dying of an ovariotomy properly performed. Ovarian tumors were invariably fatal till McDowel demonstrated the manner of cure, which has now reached such perfection that we cure from 90 to 97 per cent. of all cases. And by the application of the same rules that guide us in ovariotomy to the treatment of shot wounds penetrating the abdominal cavity, there is every certainty of attaining the same success in these that we now boast of in ovariotomy."—*British Medical Journal*, March 4, 1882.

In a rather quaintly-written but richly-laden book on surgery, by Herr L. Heister, Professor, etc., written in 1739, there occurs this passage:

"When the intestines are wounded but not let out of the abdomen, and therefore their wounds are out of reach, the surgeon can do nothing but keep a tent in the external wound, according to the rules laid down at chap. V, and after this bleed the patient if his strength will admit of it, advising him to rest, eat abstemiously, and to lie upon his belly; the rest is to be left to Divine Providence and the strength of his constitution. But the question may be asked here whether a surgeon may not very prudently, in this case, enlarge the wound of the abdomen, that he may be able to discover the injured intestine and treat it in a proper manner. Truly I can see no objection to this practice, especially if we consider that upon the neglect of it certain death will follow, and that we are encouraged to make trial of it by the successes of others. Sacherus, in Programmate Publico, Lipsiæ, ed. 1720, mentions a surgeon who performed this operation successfully."

A period of 100 years and more has rolled away since Dr. Heister published his belief and reported recovery, to the time when Dr. Sims expresses his convictions—over a century of doubts, timidity, uncertainty, and gloomy misgivings, lightened only occasionally by some bold and resolute assertions. The future asks for action, and it is not unreasonable to assert that careful trials will accomplish successful results.

Avoiding any spirit of dictation, it seems proper to tabulate the following conclusions as an outgrowth of the experiments:

1st. Hæmorrhage following shot wounds of the abdomen and the intestines, is very often so severe that it cannot be safely controlled without abdominal section; it is *always* sufficient in amount to endanger life by secondary septic decomposition, which cannot be avoided in any other way than by the same treatment.

2nd. Extravasations of the contents of the bowel after shot injuries thereof are as certain as the existence of the wound.

3rd. No reliable inference as to the course of a bullet can be made from the position of the wounds of entrance and exit.

4th. The wounds of entrance and exit of the bullet *should not be disturbed* in any manner, except to control bleeding or remove foreign bodies when present. They need only to be covered by the general antiseptic dressing applied to the abdomen.

5th. Several perforations of the intestines close together require a single resection, including all the openings. Wounds destroying the mesenteric surface of the bowel always require resection.

6th. The best means of uniting the wounded intestine after resection is by the use of fine silk thread after Lembert's method. It must include at least one-third of an inch of bowel tissue, passing through only the peritoneal and muscular coats, never including the mucous coat. The everted mucous membrane must be carefully inverted, and needs no other treatment.

7th. Wounds of the stomach, small perforations, and abrasions of the intestine, can be safely trusted to the continued catgut suture.

8th. Every bleeding point must be ligated or cauterized, and especial care devoted to securing an absolutely clean cavity.

9th. The best method of treating the stumps of divided mesentery is to save the mesenteric surface of the bowel as above indicated.

10th. *Primary abdominal section* in the mid-line gives the best command over the damage done, and furnishes the most feasible opening through which the proper surgical treatment of such damage can be instituted. Farther, its adoption adds but little, if anything, to the peril of the injury.

11th. Is not the moral effect of the assurance to the patient, that he will be placed in a condition most likely to lead to his recovery, a good substitute for the mental depression accompanying the general and popular conviction that these wounds mean certain death?

EXPERIMENTS ON GUN-SHOT WOUNDS OF THE ABDOMINAL CAVITY.

Appended to Dr. Parkes' Address.

EXPERIMENT NO. 1.

Wednesday, November 14, 1883.—Long, lean and lank setter; about 30 lbs.; in rather poor condition. Etherized with common ether and shot through abdomen with a No. 32 cal. ball, which passed directly through anterior wall to the innominate bones. Upon opening abdomen found ileum perforated about the middle and at the ileo-cæcal valve, and slightly grazed at another point. Extravasation of intestinal contents at each perforation. Some entozoa. The two perforated regions were resected and continuity of ileum re-established by Lembert's intestinal stitch. The grazed portion was closed by continued suture. Intestines washed with a feeble solution of carbolic acid, and returned to abdomen; and the external wound closed by two sets of sutures, one set through muscular walls, including peritoneum, and the other uniting the skin. Drainage tube inserted, and wound dressed antiseptically with gauze, cotton, etc.

Entire operation lasted about one hour, and conducted antiseptically, abdomen being shaved, washed and irrigated with carbolized solution, etc. The animal waked considerably shocked. Gave rectal injection of alcohol and water (1-2 1-2) about 3 drachms, and in half an hour gave 10 drops of laudanum. The dog seemed very bright. At 6 P. M. was considerably weakened; respiration very rapid, with much febrile excitement. About three-quarters of a pint of warm milk per stomach-tube, twelve drops of laudanum, and about a quarter-grain of morphia hypodermically. Tied him under register well bedded in a large comforter, and covered him with a coat.

Thursday, November 15.—Dog died between midnight and morning. Post-mortem. Abdomen filled with bloody serum and intestines inflamed and badly smelling; kidneys a bright blue, and rectum filled with hardened fæces. Dog had vomited during the night a quantity of hair and some pieces of cartilage, etc. Died of shock. Wounds of intestine well agglutinated.

EXPERIMENT NO. 2.

Friday, November 16.—The ball (32) severed the aorta.

EXPERIMENT NO. 3.

Saturday, November 17.—(Ball 32 Cal.) Dog etherized, shaved and shot very near abdominal margin. Upon opening abdomen (incision 3½ inch), but one loop of gut was found perforated. This was excised, and the continuity of intestine restored by eighteen individual silk stitches, which brought serous surface to serous surface, the greatest difficulty being encountered at the mesenteric attachment to the gut on account of the fat which lay between the two layers of peritonæum and adherent to the gut itself. Extravasation of intestinal contents. Tape worm.

Wound closed with heavy silk and dressed antiseptically. Gave 15 gtt. laudanum at night.

November 18.—Animal seems bright, but disposed to remain quiet, drinks plenty of water and urinates freely. Respiration hurried and febrile action high.

November 19.—Seemed very well, and partook of some milk during morning, but began vomiting in the P. M. a sour, watery and greenish fluid. Gave per rectum about ¼ grain morph. sulph. at night, and left him sleeping comfortably.

November 20.—Seemed quite lively and comfortable, the dressings having been removed the day before and a large body bandage applied. About 11 A. M. seemed rather tired, and vomited large quantities of the same sour fluid as before; would not eat meat or drink milk, but drank water freely. Gave about ⅜ grain morph. sulph. hypodermically, and during the P. M. he seemed extremely sleepy and much disposed to lie down flat, but is nervous and easily alarmed by sudden noises, etc., etc. This condition lasted all day, and suppose it is the effect of the morph.

November 21.—Died during night. Post-mortem showed a separation of the resection which had evidently first torn out at the mesenteric attachment. Extensive peritonitis, intestines being agglutinated together and abdomen filled with fluid blood and fæces.

EXPERIMENT NO. 4.

November 23.—(Ball cal. 32.) Very large dog, weight about seventy-five pounds. Upon opening abdomen found a section of intestine for about six inches perforated in several places, the ball apparently having skipped along inside of the gut; at another place the free edge was shot off and other portions of the ileum grazed three times. The middle section was resected entirely, and closed perfectly; the shot edge was closed by trimming edge or side of the tube of intestine by a "V"-shaped cut towards the mesenteric attachment, and that also was closed fairly well. This was close to the left end of the pancreas. Each opening showed extrusion of contents. Many worms.

The operation lasted two hours, abdominal wound closed by two sets of sutures, one set through the muscular walls, the other bringing the skin in contact. Wound was covered with cotton and bandage applied. Gave 20 gtt. deod. tincture opium and a little water. Seemed to be doing well all P. M., and at night at six o'clock gave about twenty gtt. more of the opium, and left some water where he could get it.

November 24.—Dog still alive and very thirsty, but vomits the water soon after drinking; gave another dose of opium at night.

November 25.—Bandages have not been changed.

November 26.—Changed dressings; dog seems bright. Gave pint of milk; also opium, which he drank readily, but soon vomited. Gave more milk about noon, which he retained... In the afternoon he seemed much weaker. Gave deod. tincture of opium gtt. 20 at night.

Still lives, but is not strong. Lies in any position in which placed and seems quite prostrated. Opium as before seems to revive him; he refuses milk, but

drinks freely of water, which the stomach promptly rejects. In the afternoon, being no better, removed dressings, and although wound was quite healed made an opening for a medium-sized drainage-tube and let out about a quart of bloody serum; re-dressed the wound after injecting a weak carbolized solution of warm water into abdomen through tube. Gave a rectal injection of alcohol and water (1–2 1–2) warm and gtt. 20 of opium. Is getting very poor, but respiration is regular; pulse very weak and rapid.

November 28.—Gave enema of soapy water very weak. Washed out wound and inserted short drainage-tube and fresh bandages. About eleven o'clock had a passage from bowels of a large quantity of black, tarry, and badly smelling fæces, result of injection per rectum. At 2 p. m. was very weak. Gave enema of whisky and milk, warm, about 2 oz., and made a stew of small bits of beef and milk in whisky, which he ate greedily. Gave milk and whisky per rectum every three hours, also Valentine's extract of meat.

November 29.—Seems much stronger; had a semi-liquid passage from bowels. Gave enema every four hours of Valentine's extract, milk and whisky; and also fed pieces of raw meat in milk.

November 30.—Steady improvement; another passage which evidently came from above seat of operation. Fed him on raw steak, and gave whisky per rectum every four hours. Sutures through integument have ulcerated their way out; were removed and dog allowed to lick his wound, as he promptly tears off all bandages.

December 1.—Feeding as before, with steady improvement.

December 2.—Another passage from bowels during night. Gave meat, about one-half pound every three hours, which he eats greedily; marked improvement daily in strength and appearance.

December 3.—Same improvement.

December 4.—Sent dog down stairs in basement.

December 10.—Alive and apparently in perfect health. External wound closed completely.

December 11.—Seems sick; refuses to eat; howls at night.

December 12. Has marked symptoms of tetanus, and is in a state of rigidity with episthotonos.

December 13.—Died, and post-mortem showed an obstruction of intestine by a large mass of meat or a collection of various substances of a gritty consistency which completely obstructed and occluded bowels for some distance. The bowel was opened above this, and abdominal cavity filled with intestinal contents, and organs all adhered, as result of peritonitis; resection wound quite strongly united. Dog died from careless feeding and obstruction following adhesion of knuckle of intestine to omental stump.

EXPERIMENT No. 5.

Monday, November 26.—(Ball cal. 32). Medium-sized, well-conditioned and sturdy dog. Shot passed through a six-inch piece of intestine, making several perforations. Much fæcal matter free in abdomen, some opposite each opening. Many tapeworms.

November 27.—Made a resection of but one piece six inches in length, including both wounds. In this instance the larger silk sutures were used. After the continuity of the intestine was restored there was a great deal of bleeding from the interior of the abdomen, the origin of which could not find, but allowing the air to reach into all parts of the abdominal cavity, it ceased after considerable loss of blood. A portion of the omentum being filled with blood, it was ligated and removed. In closing abdominal wound was obliged to tear away a certain amount of fat which was closely adherent to interior wall of abdomen, along the line of the wound, in order to introduce sutures so they would not include the fatty mass. Introduced two drainage-tubes, and applied large pad of cotton. Gave some opium, about gtt. 15. P. M. dog seemed considerably shocked, but was quite thirsty. At night gave more opium.

November 17.—Cotton was soaked with fluid from drain-tubes. Removed dressings, and, upon getting him upon his feet, a small quantity of fluid escaped. In the evening washed out the abdomen with a warm solution of carbolic acid, about ½, and applied dressing of gauze. During the day he vomited considerable milk and water which he had drank, and was evidently very weak. Gave about gtt. 20 of opium at night. Died at 8 A. M. on November 28. Post-mortem showed that sutures had parted at mesenteric edge, and death was from peritonitis. Mortification of edges of resection.

EXPERIMENT No. 6.

December 5.—(Ball cal. 32). Died of hæmorrhage, after being shot from wound of renal arteries, the ball perforating one kidney. Several perforations of the small intestines, all of them showing extrusion of contents. One large, round worm free in cavity.

EXPERIMENT No. 7.

December 7.—Died under ether.

EXPERIMENT No. 8.

December 7.—(Ball cal. No. 32). Ball opened one of the mesenteric arteries, and after resecting three pieces of intestine, and closing wound nicely (every perforation showed fæcal matter, worms, etc.), she died in less than nine hours from the shock. Great loss of blood; died of loss.

EXPERIMENT No. 9.

December 10.—(Ball cal. 32). Gave morphine hypodermically at 9 A. M. Medium-sized female dog. Anæsthetized at 9 A. M., and shot at 9.30, first shot simply going through abdominal walls, second shot higher up and perforating spleen. Operation began at 10.15. Found abdomen full of blood, fæcal matter, and some worms. Removed spleen and large mass of omentum; ligated and removed one piece; resected about three inches in length, perforated in two places. Much hæmorrhage; operation concluded at twelve. Gave opium and whisky; much shocked. Died.

EXPERIMENT NO. 10.

A well-nourished bull-dog (female), about twenty-five pounds in weight. Was anæsthetized about 9.15 A.M., and then shaved over the abdomen. Was shot at 9.45 by a 32-100 caliber revolver just posterior to the umbilicus, the bullet entering on the right side about three inches from the median line, the point of exit being in the corresponding situation on the opposite side. On opening abdomen found animal pregnant. There was one wound through the right cornu of the uterus, rupturing the membranes of one fœtal dog, and allowing the escape of the amniotic fluid into the peritoneal cavity. One of the smaller mesenteric arterial branches was cut, and the small intestine perforated in one place. The abdomen contained considerable blood on opening immediately after the shot, and there was slight extravasation of fæcal matter from the gut at openings. The vagina and uterine ligaments were ligated by single carbolized silk ligatures, and the large gravid uterus removed. The hæmorrhage in the mesentery having been checked, the wound in the intestine was resected, about two inches being removed. The free ends were united with the interrupted silk ligature. The peritoneal cavity was sponged out and washed with slightly carbolized warm water. The external wound was united with about ten silk ligatures, and dressed with iodoform and gauze, the whole being covered with oakum and bandaged. About half a grain of morphia was administered hypodermically; and at twelve the dog was allowed to come from the influence of ether. She showed marked symptoms of shock, but rallied in the afternoon. She died in the night. Post-mortem revealed hæmorrhage from the uterine stumps, and some peritonitis commencing.

EXPERIMENT NO. 11.

A full-grown, healthy-appearing dog. Etherized at 9.30 A. M. Abdomen shaved and cleansed. Was shot at 10 A. M., still under the influence of ether, the bullet from a 32 S. & W. revolver passing transversely through the lower part of abdomen. Was placed on table and kept partially anæsthetized until 10.45. The animal then presented signs of extreme loss of blood, feeble respiration and heart action, cold extremities, pallid gums, etc. Abdomen was opened by large crucial incision and found to be filled with blood. Bleeding was ascertained to come from a divided mesenteric artery, and was readily checked by ligature. Clots were turned out, and two wounds of small intestine found. But slight extravasation of contents of bowel into the cavity, still some matter and worms found at openings. The intestine was resected at the site of each wound, about three inches being removed in each place. The cut ends of each were then united by about twelve interrupted silk sutures, so placed as to bring peritoneal surfaces in apposition. Intestines were then returned to their place, the cavity sponged out, and the external wound closed tightly with silk sutures. This was finished at twelve o'clock, the dog appearing moribund at its close, and remaining in a condition of collapse for about three hours. Reaction then took place, and he was able to stand and walk about. Second day took some milk, which was vomited at once. This was repeated at intervals during second and third days. Dressings were changed on third day. No discharge from wound. On fourth day vomiting was increased, and was fæcal in character. Dog too weak to stand. Dressings changed again and wound found to be discharging purulent fluid. Died at 4 P. M. on fourth day. Post-mortem showed sero-purulent exudation in abdominal cavity, intestines glued together by adhesive lymph, wounds uniting well, and occlusion of the bowel in the neighbourhood of one of them, from its having been sharply folded upon itself and bound in the position by the inflammatory exudate.

EXPERIMENT NO. 12.

December 27, 1883.—The bullet, 32 cal., entered the abdomen on a line corresponding to the junction of the anterior and lateral surfaces of the abdomen, just in front of the hind leg, its point of exit on the other side being on the same line a little above the umbilicus.

On opening the abdomen it was found that the lower part of the jejunum was cut in two places within two inches of each other, and that there was considerable blood in the peritoneal cavity from these cut surfaces, there being no mesenteric vessels cut; also fæces and worms.

Both wounds were included in the part excised, and the cut ends of the intestine were fastened together by three sutures, and then stitched to the abdominal parieties, thus forming an artificial anus.

Considerable shock was experienced, and owing to a desire to hasten the operation, the peritoneal cavity was not as carefully sponged as it should have been.

The dressing consisted of iodoform, protective and oakum. Of tinct. opii. deod. gtts. 20 were given by the mouth. The operation lasted two hours. On the following day he took a little nourishment; there was no tenderness, but some pus was squeezed from the point of exit of the bullet, the dog lying on that side.

Next day about one-half ounce of pus was forced from the point of exit of the bullet, the dog lying on that side, and by turning him onto the other side an equal amount was obtained from the point of entrance, but there was no suppuration from the wounds themselves.

He took a little nourishment and seemed to be in good condition, respiration being normal and pulse regular. He had a free urination from the bladder, and soft stools were passed from the artificial opening. He died during the night. Post-mortem revealed a large amount of septic material in the peritoneal cavity.

EXPERIMENT NO. 13.

Saturday, December 29.—(Ball caliber 32.) Medium-sized, middle-aged female dog. Gave with the anæsthetic about $^3/_8$ grain of morphia hypodermically after shot. Abdomen found full of blood; seat of hæmorrhage found at one of the points of perforation, of which there were two; from these issued fæcal matter, gas and worms; a medium-sized mesenteric artery having been shot off. All the intestines were drawn out of abdomen for examination,

and it was found necessary to resect two portions which were a considerable distance apart, both places closing neatly and perfectly. Abdomen washed out and external wound closed by one set of sutures and a large pad of oakum laid over and held in place by roller first, and over all a many-tailed bandage. Gave 25 gtt. laudanum.

December 30.—Dog got loose during night and was running around very briskly; room very cold and disagreeable. (On the afternoon of the day of operation some person had opened the doors and windows and exposed the animal to a strong, cold draft for about two and one-half hours.) In the evening gave hypodermically morphine, when she vomited for first time and seemed very weak.

December 31.—Seemed lively and well all day; gave milk, which she would drink but could not retain. About noon gave an enema of Valentine's extract, and in the evening left a pan of milk.

January 1, 1884.—She seems as well as ever, but the floor of the room was profusely decorated with vomit. The milk was all gone. Gave an equivalent of an ounce of whisky, of alcohol and water per rectum, and left a supply of water, as she seemed very thirsty. Bandages changed for the first time since the operation. There had been but little discharge and the wound was in good condition. Applied a large pad of oakum and a wide roller as before.

January 2.—Seems quite exhausted. Gave alcohol and water (1-2 1-2) per rectum about four or five times a day in quantities of about 1 ounce; has a diarrhœa and vomits.

January 3.—Diarrhœa continues, but no vomiting. Has some appetite, and gave raw meat (steak) chopped fine, every two or three hours; also fresh milk, which she drinks readily.

January 4.—Seems quite well, and hungry; fed regularly and removed all dressings; wound in good condition. Removed all stiches and did not apply dressing again. Appetite good.

January 5.—Dog is seemingly well; has a voracious appetite. Much wasted in flesh, but appears strong.

January 6, 7, 8.—Fed her upon milk; also meat chopped fine and raw.

January 9.—She seemed well enough to be sent down cellar, where she continues gaining strength and flesh.

January 15.—Is perfectly well. Recovery.

Experiment No. 14.

January 9, 1884.—This dog was allowed some milk a short time previous to the operation, hence his stomach was distended.

The first bullet (32 calibre) grazed the abdomen walls, not entering the peritoneal cavity.

The second entered on a line corresponding to the junction of the anterior and lateral surfaces of the abdomen, a short distance in front of the hind leg, coming out a little nearer the median line, and two inches nearer the front leg.

On opening the abdomen it was found there was some hæmorrhage, mucus and particles of food in its cavity and on surface of stomach, and that the lower part of the stomach was wounded, the point of exit being two inches from the point of entrance, passing through the whole thickness of the stomach. There was no wound of the gut. The peritoneal surfaces were drawn together with cat-gut, by inverting the edges and using the continued suture.

Great care was taken in the *toilet de peritonie*. Immediately after closing the external wound he vomited half a pint of blood, mucus and milk. Time of operation was one hour and a half. Then he was given tincture of opii deod. gtts. xx.

The wound was dressed with iodoform, protective and oakum.

On the tenth was given nothing except a little water. On the eleventh he was given a little milk, which caused some disturbance. On the sixteenth the stitches were removed and no dressing applied, there being but slight discharge from the wound made by the incision and none from the bullet wounds. Recovered.

Experiment No. 15.

Small dog, female, was anæsthetized and shot at 10:30 a. m. (S. & W. revolver, 32 calibre.) First wound passed through abdominal muscles only. Shot again immediately, bullet this time passing transversely through middle of abdomen. Opening made at once by linear incision. But little blood in cavity. All bleeding stopped upon exposure of intestines to air. Five wounds of small intestine found, all showing extravasation of contents. Two resections of five inches each were made to include all wounds. Cut ends were united by a continued cat-gut suture in each place. Intestines returned and abdominal incision united by silk sutures, after thoroughly washing out cavity by 2 per cent. solution of carbolic acid. The operation was finished at 10:30 a. m. Dog was laid in a warm place, apparently suffering but little from shock. External wound dressed with iodoform, covered by protective carbolized gauze, tow, and a bandage. Animal died in about twenty hours. Was not given any food or medicine in that time. Post-mortem showed some small blood-clots about the wounds in the intestine. No serum or other fluids in cavity, and no signs of peritonitis. Death from shock.

Experiment No. 16.

A dog of uncertain breed, about 20 pounds in weight, was shaved over the abdomen and anæsthetized at 10 a. m. Was shot in the abdomen in front of umbilicus, the bullet entering on the right side and coming out on the same side about two inches nearer the median line, not entering the abdominal cavity or wounding the peritonæum. Was shot again, the bullet entering on the right side, external and posterior to the first, and coming out on the opposite side, about two inches from median line. The calibre of the revolver was 32-100. Upon opening the abdominal cavity the peritonæum was found to be plowed across between the wounds of entrance and exit, and the spleen to be slightly nicked, the bullet having skirted the abdominal walls. The only hæmorrhage was from the external wounds and the spleen and track of bullet. The spleen was removed, its

peritoneal connections being ligated by five silk ligatures. The small intestine was resected, about four inches being removed. The abdominal cavity was washed with warm carbolized water. The external wound was sewed up by about ten sutures. The dog came from under the influence of ether at 11:30 A.M. The wound was dressed externally with iodoform and oakum, and fifteen drops of deodorized tr. of opium administered by the mouth. A curious phenomenon was observed upon cutting out the spleen. The stomach and intestine became distended enormously with gas, extruding from the abdominal cavity and covering a large area of the operating-table. They were with difficulty returned with steady pressure. The dog died in the night from shock and hæmorrhages from splenic stumps.

EXPERIMENT NO. 17.

January 23.—(Ball cal. 32.) Good-sized coach dog. Bullet passed through abdominal walls without wounding intestines and just entering the peritoneal cavity, as was found after opening abdomen, the point of entrance and exit being on either side of the middle line and five inches apart. Removed the major portion of the greater omentum and also resected about six inches of the ileum and closed the wound by five sutures, the external wound being but two inches long.

January 24.—Seems inclined to be quiet all day; had defecated during the night and urinated very little; drinks but little water, and does not vomit it. Is by nature a very frisky dog, and do not think his extreme quiet very favorable.

January 25.—Seems quiet; no bloating of abdomen; removed bandages; re-applied dressings. Refused milk all day; also water.

January 26.—Gave small quantity of milk in the afternoon; re-applied the dressings which had been removed the day before; found the bullet-wounds much puffed up, and that the stitches had slipped in two places, leaving a hole opening into abdomen large enough to admit little finger. The portion of intestine viewed through opening in external wound looked red and inflamed, but not badly so; little running from the wound. Filled it with iodoform and applied pad of oakum.

January 27.—Gave about one-half pound of meat and a quart of milk; seemed to be ready to get well.

January 28.—Fed meat and milk during day, and he seems to be rapidly getting well.

January 29.—Wound gaping, but discharged him to the cellar. Recovered.

EXPERIMENT NO. 18.

January 25, 1884.—This dog, a black and tan bitch, having been shaved the day before, was anæsthetized and shot.

The bullet, 32 caliber, passed directly through the abdomen about its middle, piercing the gravid uterus in two places, and cutting the gut longitudinally. No large vessels were cut. The uterine attachments were ligated *en masse* and the uterus removed. Contents of bowel found at site of wound in intestine.

During the time that an excision of the gut was being made, a profuse hæmorrhage occurred from the uterine stumps, before they could again be ligated by passing a suture through and ligating one-half at a time, the animal was almost exhausted from hæmorrhage.

The excision of the gut was then completed, and the cut ends stitched together with silk. The peritoneal cavity was then thoroughly washed out with slightly carbolized warm water, and the external wound closed. The dressing consisted of iodoform, gauze and oakum.

Of tinct. opii. deod., gtts. xx were given. Death occurred within ten hours after the operation, from effects of the hæmorrhage.

EXPERIMENT NO. 19.

Dog was full-grown and apparently healthy. When the abdomen was exposed by shaving, two small abscesses, each the size of a filbert, superficially seated and non-inflammatory, were discovered. They were not disturbed. The animal was anæsthetized at 8:30 A. M., and at once shot through the middle of abdomen with a 44 caliber revolver. The dog was placed upon the table, and a linear incision of about three inches made in the median line. It was there found that the ball had glanced upon the abdominal muscles, and instead of going through the mass of small intestines, had been deflected so that it just entered the peritoneal cavity beneath the linea alba, traversed the cavity for about an inch, producing a contused wound of a fold of intestines, and then entered the abdominal parietes to make its exit opposite the wound of entrance, about two inches from the linea alba. Only a small amount of blood was found in cavity. Although none of the intestines were wounded, a resection of about two inches from the middle of the ileum was made. The divided ends were united by about a dozen interrupted silk sutures. The cavity was washed thoroughly with a 1 per cent. sol. of carbolic acid, the intestines returned, and stitches were being placed in external wound, when the abdominal cavity was found to be filling with blood. Source of the hæmorrhage was found to be a branch of mesenteric artery at the site of the resection, which had commenced to bleed as soon as circulation was restored by warmth of abdomen. A ligature was applied, the intestine returned and the cavity again thoroughly washed out. The external wound was now closed by silk sutures, the wound dusted with iodoform, and dressed by applying a few thicknesses of carb. gauze, covering this with a mass of tow and a bandage over all. Animal appeared to suffer but little from shock. On morning of second day was given ¼ grains morphia with 1-100th grain atropia by the mouth.

On third day appeared greatly prostrated, vomited at intervals, and a muco-purulent discharge was noticed coming from nostrils and eyes. Vomiting ceased on fourth day. Prostration and evidence of fever kept up to the morning of fifth day, when improvement began. Discharge from nostrils continued about ten days. On the fourth day a small quantity of milk was taken and retained. Loose discharge from bowels on fifth day, slightly colored with blood. A rectal injection of alcohol; water was

given on the sixth day. Dressings changed for the first time on sixth day. Wound appeared healthy and united in its deeper portions. Some pus from superficial part of wound from this time on, the dog ate milk regularly, and had regular and normal passages from bowels. On ninth day sutures were removed from external wound, which had entirely closed. On the thirteenth day, February 10, 1884, dog is apparently perfectly well; has been eating regularly of raw beef, and has begun to gain in flesh. On the evening of thirteenth day dog was well. Recovery.

EXPERIMENT NO. 20.

February 2.—(Ball cal. 32). Died from ether before any incision was made.

EXPERIMENT NO. 21.

A strong black dog, about 20 lbs., was shaved over the abdomen and then etherized at 9.15 A. M. Was shot with a 38-100 caliber revolver through the abdomen about opposite the umbilicus, and five inches to the right of the median line, the point of exit being in a corresponding situation on the opposite side. Upon opening the abdominal cavity such a large amount of blood was found that it was necessary to enlarge the incision by a cross cut. A large mesenteric artery was found to be cut and was ligated. Another smaller one was treated in the same way. There were two wounds in the small intestine close together, about six inches intervening between them. Extravasation of contents from both. One was perforating and the other nicking the gut on the mesenteric side. Eight inches were removed, and the free extremities of the intestine united by interrupted silk sutures. There were three other wounds nicking the intestine which were sewed in the same manner without resection. The end of the cæcum, which is peculiarly shaped in dogs, was shot off. Stained mucus and some shreds at the opening. This was sewed, turning the cut end in. The spleen was cut in one place, which was left with one deeply-planted suture. A large fold of omentum was ligatured and removed. The abdomen was thoroughly washed with carbolized water, and the external wound united with about fifteen sutures. It was then dressed with iodoform and oakum, ½ ounce of alcohol and 15 gtts. of deodorized tincture of opium were administered per rectum, and at 12.15 the dog was allowed to come from the influence of ether. The same amount of alcohol and opium were administed as before at 6 P. M. The dog died during the night. Post-mortem revealed no evidence of inflammation, and some slight bleeding from the spleen. The sutures in the intestine were in good condition. The piece of gut, about eight inches long, supplied by the mesenteric artery, which was cut by the bullet, was found to be completely mortified.

EXPERIMENT NO. 22.

February 12, 1884.—(Ball cal. 32). Brindle bull dog. No attempt to sew up the holes in the intestines, of which there were about twenty. Died the day following. "Tilley's anæsthetizer." Every opening showed evidence of extrusion of contents.

EXPERIMENT NO. 23.

February 28, 1884.—Tilley's anæsthetizer. Died before operation from effects of ether.

EXPERIMENT NO. 24.

February 28, 1884.—(Ball cal. 44). A short, strong, Spitz dog. Bullet wounds of entrance and exit 4 in. apart. Intestine perforated in four places and abraded in one spot. Intestinal worms free in abdomen. Tape worms protruding from perforations.

Extravasation of contents of the bowel. No arteries divided by bullet. Resected one piece, (including three perforations) 12 in. in length. Removed a V-shaped piece including the fourth perforation, and inverted the serous surfaces by interrupted sutures, the same as in complete section. The apex of the V (pointed to the attached border of the bowel) controlled the oozing from the abraded spot by small suture passed across the mesenteric side of abrasion, the abrasion being the size of a copper cent, and on the side of intestine. Washed the intestines and abdomen cavity as clean as possible by stream of weak carbolized and pretty warm water from the irrigator; closed abdomen wound by five deeply-placed sutures about one-third inch apart; gave hypod. of one-fourth grain of morphia. Shock and little loss of blood. Omentum also removed.

February 29.—In morning seemed very lively and bright; gave some water, which was immediately rejected by stomach. During morning vomited foul-smelling fluid and two large chunks of meat. About 10 A. M. gave hypod. of one-half grain morphia; in very few minutes he laid down and began to whine as though in pain, and threw up large quantity of offensively-smelling fluid. Died about 3 P. M.

Post-mortem.—Abdomen showed evidence of intestinal extravasation, all organs being bound together by peritoneal inflammation; extravasation of blood beneath peritoneal covering of intestines, and small clots adherent all along the length of ileum. The stumps of ligated mesentery and omentum were black. The seat of the operation showed adhesion of the serous surfaces, and water could be forced through the excised piece which was taken out by a cut six in. to each side of the stitches, without any leaking at seat of operation. The spot of abrasion was swollen and blue, and there had been a little hæmorrhage from it. The intestines generally were contracted, glued together, and pressed into prismoidal and other shapes. Stomach empty.

EXPERIMENT NO. 25.

February 28, 1884.—(Ball cal. 44). "Tasso." Bullet under skin opposite to point of entrance. Intestine riddled in about four places, for which a complete section 20 in. in length was removed and was nicely adjusted; another hole in the ascending colon was closed on each side by the continuous suture; the tip of the spleen being shot off, to arrest hæmorrhage a ligature was passed around proximal side of wound tight enough for that purpose, but yet not enough to cause death of the spleen tissue beyond ligature. The stumps of ligated mesentery being gathered upon a suture, were united to intestine near or about at the seat of the approximation of the divided ends; omen-

tum removed; gave rectal injection of alcohol and water ½ ½ about. Each opening in bowel had more or less of the contents around it.

February 29.—Seemed very quiet all the morning, and was quite indisposed to move. Towards noon, gave him, about 11 o'clock, about 1 oz. of alcohol and water ½ ½ per rectum and some water to drink, which was at once vomited. Seemed very tired all day, and disposed to lie stretched out before the heat of the register, and his breathing was entirely thoracic and by means of the cervical muscles. At 6 P. M. gave hypod. of morph. gr. ⅜, and left water where he could drink.

March 1.—Seemed very weak all day; gave hypod. of morph. ½ gr. twice, the last at night. About noon gave rectal injection of alcohol and water.

March 2.—Still alive, but very cold; listless and indifferent; gave morph. in A. M., and tied him up in blanket. Returned at nine P. M., and poor "Tasso" was in rigor mortis. I think the exposure to cold during the day (Sunday) which was a very wintry day, was in great measure the cause of his death. He refused to drink any milk during the day, and also seemed to have lost his thirst for water.

Post-mortem March 4.—Extensive peritonitis present; no separation of the united intestine to be found at the seat of operation.

EXPERIMENT No. 26.

March 3.—(44 cal. cartridge). Large, fat and old bitch. Used Frank Gould's revolver, 44, and upon opening the abdomen, found four large rents in the intestines (every one of which showed extrusion of contents and some worms) at a considerable distance apart, and a very profuse hæmorrhage from the wound of exit, which was not discovered until the resections were made, of which two included the wounds in the gut, which was about shot off, and much bleeding took place before they were found and ligated. The animal was so fat and boggy that it it was with the greatest difficulty that hæmorrhage could be controlled, and the beast was old and presented signs of cataract in both eyes. The bladder was greatly disturbed, and the structure of the intestines themselves seemed "sleazy," and the sutures tore out with readiness upon slight traction. Cleansed out abdomen as best we could by thorough washing, but a little bleeding was going on when the wound was closed in the abdomen, and the operation given up as a bad job of one-half hour's duration.

March 4.—Found dead.

EXPERIMENT No. 27.

March 4.—(44 cartridge). Medium-sized dog; died from shock on night of 4th.

EXPERIMENT No. 28.

March 6.—(Ball cal. 22, revolver). Very small, black and tan dog. Shot him with a 22 cartridge, and had to use three shots before could get a good perforation and but little bleeding. Resected a piece around the bullet-hole of ¾ inches long, cleaned abdomen and closed tightly; gave morph. gr. ¼.

March 7.—Seemed very bright.

March 8.—Gave little milk and morphia in evening.

March 10.—Milk.

March 11.—Sent down cellar to be fed on milk.

March 12, 13.—Very hearty, and eats ravenously of milk and very little meat.

March 14, 15.—Doing nicely. Recovery.

EXPERIMENT No. 29.

March 6.—(Ball cal. 44). Large, strong dog. Used 44 cartridge. Found the abdomen full of blood; spleen perforated, and intestines wounded in three or four places. From these issued fæces, gas, etc. Removed spleen, omentum, and resected about 12 in. gut, including all the holes but one, which was sewed up by continuous stitch. The animal having lost nearly all his blood by this time, and as death was sure to ensue, one of the mesenteric arteries was ligated to ascertain results.

March 7.—Found dead in morning.

Post-mortem.—Intestine black, but the animal had evidently not lived long enough to get any positive mortification of ligatured part, or any interesting appearance at all.

EXPERIMENT No. 30.

March 10.—Tilley's Inhaler. Large chandler bitch. Killed by ether.

EXPERIMENT No. 31.

March 10.—Tilley's Inhaler. Large Hastman dog. Killed by ether.

EXPERIMENT No. 32.

March 10.—(Ball cal. 22, rifle). Medium-sized bitch. Found three mesenteric arteries severed, and intestines riddled in many places and far apart. Perforations showed fæcal matter and tapeworms. Stopped bleeding and returned intestines without closing the perforations, and closed abdomen. No dressing but iodoform (C. T. P.). Spleen also removed, being perforated.

March 11.—Still alive, and sent down cellar.

March 13, A. M.—No better.

March 14, 15, A. M.—Vomiting, and refused food.

March 18.—Dead. Peritonitis septic. Pockets of fæces.

EXPERIMENT No. 33.

March 10.—Small dog (yellow). Shot with 22 cal. rifle. Three perforations of small intestine, showing fæcal matter. Removed a 4-in. piece in two places, and brought ends together very closely; stitched mesenteric stumps to attached border of intestine. Removed omentum, tying tightly, and also putting in three side stitches connecting sides of stumps on each side of ligation with one another.

March 11.—Alive, but feverish and vomiting.

March 12.—Died. Separation at seat of operation, and stumps mortified. See specimen. Fæcal extravasation.

EXPERIMENT No. 34.

March 12.—(Ball cal. 22 rifle). Old, mangy bitch. Died under ether, Tilley's Inhaler. Perforation showed extravasation of contents, fæcal matter and worms.

EXPERIMENT No. 35.

March 12.—Medium-sized, short-haired, yellow

cur (white nose). Shot with 22-ball rifle. Upon opening the abdomen, found blood flowing from a rent in the side of spleen. This organ was three times the normal size, but no holes in the intestines anywhere, and no hole could be found in the abdominal wall on either side. The bullet lay next the abdominal muscles, and was cut out from the wound of entrance. Free bleeding from the laceration in the spleen, which was controlled by a continued suture. Resected six inches of intestine and closed abdomen. Also omentum removed. Iodoform and oakum dressing; gave morphia.

March 13.—¼ gr. morph. A. M.; very weak P. M.

March 14.—Morph. A. M.; very weak P. M. Temperature 102.

March 15.—Re-opened, but found intestine in solid mass and filled with badly-smelling fluid. Washed out as best I could and reclosed. Seat of operation showed mortification on one side, and stumps of mesentery also were black and soft.

March 16.—Still alive. Morph. gr. ¼.

March 19.—Dead. Found intestinal worms in abdominal cavity.

EXPERIMENT NO. 36.

March 12.—Short, black, stumpy and very fat dog. Fired four 22-balls at the animal before was sure that any had entered. Found abdomen full of blood; two perforations five inches apart, and two mesenteric arteries shot off near the gut. Each perforation showed extravasation, fæces and worms. Ligated the arteries; resected one piece, including both holes; sponged out abdominal cavity; removed omentum, also a large quantity of fat which hung to the inner wall of the belly, and closed wound. Iodoform and oakum dressing; gave morphia.

March 13.—Quite bright. Morph. A. M. and P. M.

March 14.—Dead. Post-mortem. Found considerable peritonitis and mortification of the ends of the intestines where they were stitched together. The stumps of mesentery and omentum also showed signs of mortification.

EXPERIMENT NO. 37.

March 13.—Medium-sized brindle bitch. No. 22-ball rifle. Resected one piece six inches having two holes; removed omentum very little; hæmorrhage; gas and fæces from wounds; temperature $98^{2}/_{5}$ at close of operation.

March 14.—¼ gr. morph. A. M. Temperature $102^{2}/_{5}$. Morph. P. M.

March 15.—¼ gr. morph. P. M.; temperature $102^{2}/_{5}$.

March 16.—Morph. P. M; temperature 102.

March 17.—Gave milk and morph. P. M.

March 19, 20.—Gave milk and morph. P. M.; seems well.

April 22.—Perfectly well; recovery.

EXPERIMENT NO. 38.

March 13.—Medium-sized yellow dog (with bare spot on tail). No. 22-ball rifle; found one lateral hole which closed by continuous suture, and three holes which were included in one piece which was cut in half by mistake; two arteries gave some bleeding, but were ultimately controlled. Contents of bowel found at each wound. Abdomen closed while yet there was some oozing from the wound, which ceased when bandages were applied; omentum removed.

March 14.—Very weak and much prostrated. Refused to lie down, and can stand with difficulty on his feet. Gave morphia ⅜ hypodermically, morning and evening.

March 15.—Found dead. Post-mortem. Mortification at seat of operation, and escape of intestinal contents.

EXPERIMENT NO. 39.

March 14.—(Ball 22-cal. rifle.) Medium-sized brindle dog (wolf face); found three ragged holes. Resected one piece which included all openings, the piece being seven inches long; closed neatly, the omentum being removed also (many tapeworms and considerable fæcal matter from openings), then washed clean by irrigator. The entire ileum was inspected and sponged off, and returned to abdomen. Spleen also pulled out and inspected; gave morphia and dressings of iodoform and oakum.

March 15.—Some shock; morphia.

March 16.—Morphia P. M. only.

March 17.—Morphia P. M. only.

March 19.—A. M. morphia, stercoraceous vomiting, and seems very sick; P. M. is evidently dying.

March 20.—Vomiting has stopped, and seems much better. Died in the evening. P. M. Septic peritonitis. Post-peritoneal abscesses.

EXPERIMENT NO. 40.

March 14, 4:45 P. M.—A young, black, bitch pup; anæsthetized and abdomen opened without shooting; ligated a mesenteric artery and closed wound to be re-opened to-morrow P. M. and resect the part supplied by ligated vessel; gave morph. 3-8.

March 15.—Opened her at 3 P. M. in presence of Prof. Parkes. Intestine supplied by the ligated artery seemed softer than normal and its mesentery showed inflammatory exudate considerable effusion; closed wound, gave morphia at night.

March 16.—Gave morphia, gr. ¼.

March 17.—Sent down stairs.

March 19.—Seems quite well.

April 22.—Perfectly well. Recovery.

EXPERIMENT NO. 41.

March 19.—(Ball 22 cal. rifle). Medium-sized young bitch (black). Found one abrasion which closed up by continued suture and the intestine in another place was about shot off; fæcal matter scattered all about, worms divided; resected the piece about one inch long; irrigated the abdomen cavity; removed omentum and then found a hole or rather the tip of the spleen shot off which bled some and was controlled by two interrupted sutures; gave morphia, gr. ¼, and applied dressings.

March 18, 19.—Morphia, gr. ½.

March 20.—Seems bright, but very quiet.

April 22.—Quite well. Recovery.

EXPERIMENT NO. 42.

March 19.—Twenty-two ball rifle (brindle, white bitch). Found one abraded edge and one hole through free edge of ileum, from which contents

issued. Closed one by continued suture and resected across the hole by cutting out a ¾ inch piece. Did not remove omentum. Gave morphia ⅜ and applied dressings.

March 18 and 19.—Morphia. Seems to have a paralysis of left fore-leg since operation and for two days past seems to be salivated.

March 20.—Better.

April 22.—Well. Recovery.

EXPERIMENT NO. 43.

March 20.—(Stub tail). A small ½-breed terrier dog. Twenty-two ball rifle. Found two perforations and one abrasion, extravasation of gas and stained mucus and shreds of matter from openings going through mucous coat. Made a resection including all three wounds, the excised piece being six inches long, closed very snugly and connected the ligated mesenteric stumps with the attached border of intestine by a single ligature passing through both stumps (but two sets of vessels having been ligated) and both sides of the mesenteric borders of the united ends of the gut; removed omentum and irrigated abdomen cavity freely with a 1 per cent. of carbolic acid solution. Dressings, oakum and iodoform; gave morphia, ¼. Recovery.

EXPERIMENT NO. 44.

March 20.—A young, shaggy, cur dog opened without shooting, and litigated three sets or branches from the superficial mesentery artery, close to the main artery, and also a good-sized anastomatic connection with an adjoining vasa intestine tenuis, which ran parallel with and along the attached border of the bowel. The intestines supplied by the vessels blanched immediately. Closed abdomen; gave morphia, gr. ¼; applied dressings. Recovered.

Died subsequently from ether during examination as to result of above operation six days after it. Found intestine perforated by stick of wood four inches long, rolled in twine. Had removed it, and was about to sew up wound when ether killed him.

EXPERIMENT NO. 45.

March 20.—A good-sized spaniel dog (old). Stopped breathing once from ether before shooting. Shot with a rifle twenty-two ball. Found the abdomen full of blood, two arteries having been shot off and the ileum perforated in four places; from each contents extruded, two being so near together and the wounds so great as to almost carry away an entire segment of the bowel, necessitating a removal of about twenty inches. Much bleeding, which took about half-an-hour to control, being from the ligated stumps and bullet-wounds; the tissues were very brittle, and so loaded with fat as to make the operation difficult. Died in one half-hour after closing abdomen wound.

PNEUMONIA.—Professor Purjess, of Buda-Pesth, claims to have found the Micrococci of Friedländer in other diseases besides pneumonia; and consequently denies the infectious character of the latter disease.

MEDICAL PROGRESS.

MEDICINE.

A NEW METHOD OF TREATING NOCTURNAL INCONTINENCE OF URINE.—J. F. Anderson, L.R.C.P., gives us in the *Australian Medical Journal* what is certainly an original method of treating nocturnal incontinence of urine. He places a battery at the head of the bed, attached to the poles of which are two long insulated wires, that pass underneath the pillow and down the patient's back, terminating in two small exposed copper loops placed a little distance apart on the perineum. One of these wires, before reaching the perineum, is brought round to the pubes in front, and there passes down inside a small India-rubber bag, shaped like the upper part of an ordinary male urinal, but closed at the bottom. At the lowest part of the bag this wire is filed clean through, leaving the two metallic ends exposed, and about an eighth part of an inch apart. Into this bag the penis of the patient is put.

Now set the battery in action, and let the patient go to sleep. So long as the bag is empty no current passes, but let the smallest drop of urine be voided, it immediately passes to the bottom of the pouch, fills the interspace between the filed ends of the wire, and so completes the current, the current passing through the body of the patient from one copper loop to the other; immediately the perineal muscles contract and the patient is awakened.

SURGERY.

TRAUMATIC CEREBRAL ABSCESS EVACUATED THROUGH THE NOSE; RECOVERY.—*The Lancet* gives us a reference to the report of Dr. Tassi to the Royal Academy of Medicine of Rome, who presented a patient, who, three months previously, had sustained a comminuted depressed fracture of the skull in the left frontal region. The patient, F. B., from Civita Vecchia, was a robust railway engine-driver. The blow had been inflicted with a sledge-hammer; and the extensive comminuted and depressed fracture was complicated with diffuse hæmatoma and very serious cerebral symptoms; loss of consciousness, high fever, paraplegia, and paresis of rectum and bladder succeeded. Antiphlogistics and counter-irritants were employed, and the propriety of trephining was discussed. Some sero-purulent fluid escaped through the center of the wound, which admitted a probe for a considerable distance into the cranial cavity. The symptoms of cerebral irritation and compression increased, the limbs became contracted, divergent strabismus and priapism ensued, and the speech was monosyllabic and unintelligible. The seventieth day after the injury, sero-purulent fluid suddenly burst from the left nostril, and continued for four or five days, amounting in the aggregate to several ounces. As the discharge progressed, the symptoms of irritation and compression decreased. The patient first recovered consciousness and speech, then sensitive and motor power. In the course of fifteen days, all the

functions of organic life were restored to the normal standard, and in three months from the date of injury, the patient was able to return to work.

ANATOMY AND PHYSIOLOGY.

ON THE MOVEMENTS OF THE BRAIN WITHIN THE CRANIUM.—M. J. Luys has made a long and interesting communication on this subject to the Paris *Académie de Médecine* (*Bulletin*), in which he gives the results of his experiments as follows:

1. The brain is not as immovable in its cranial box as one is led to believe. Besides the intrinsic movements, due to its expansion and contraction, it has also certain movements which are independent of these.

2. When a man passes from the dorsal decubitus to the abdominal decubitus, his brain follows the movement and glides gently from behind forwards, simply in agreement with the force of gravity and aided by the yielding of the arachnoid membrane whose physiological purpose is naturally explained in conformity to that law of anatomy which prevails wherever there is movement in the economy, as there is a serous membrane to facilitate that movement.

3. When the body is in the vertical position, the cerebral mass settles down and recedes from the cranial vault, to a degree amounting in the cadaver to about 5 to 6 millimeters, slightly less in the living subject.

4. When the body assumes the lateral decubitus, the cerebral mass follows the law of gravity, the superior lobe presses lightly upon its congener over the falx cerebri, which offers but little resistance.

5. The cephalorachidian fluid may modify these movements a little, but does not overcome them, for there is always in the normal condition a space between the cranium and the encephalic mass.

Admitting these facts he applies them in explanation of certain physiological and pathological conditions.

The change of position from the horizontal to the vertical causes by increased pressure of the brain downwards, a change in the vessel trunks of the circle of Willis, a partial obliteration and a consequent condition of general ischæmia for the superior regions. In this way he explains the vertigo that affects some persons on assuming the erect position after lying in bed for a length of time. This also in his opinion serves to stimulate the organic sensibility of the cerebral tissue, to awaken the brain after a night's sleep, for example. In pathology he ascribes the severe cephalalgia which accompanies meningitis as due to the movements of the brain influencing the inflamed and sensitive surfaces of the serous envelope.

MATERIA MEDICA AND THERAPEUTICS.

ETHERIZATION BY THE RECTUM.—An editorial in the *Boston Medical and Surgical Journal* gives the experience in Boston of the use of this method as showing that if there are advantages there are also grave objections to the method. In many cases the effect has been out of proportion to the amount of ether used, as it continues to be absorbed after anæsthesia was already complete until it became profound, sufficient in certain cases to cause anxiety. In these cases in which the insensibility grows deeper and deeper, it is impossible to withdraw the anæsthetic. A rectal tube fails to evacuate any sufficient quantity of gas, and one can only have recourse to stimulants and general measures until the effects have passed away. This prolonged effect has followed the smaller doses, and in patients where there was no reason to expect such results. These cases have not rallied easily. In doing away with the local difficulties about the air passages, other local difficulties have shown themselves in the rectum and bowels. The diarrhœa has, in some cases, been marked, and occasionally blood has been passed in sufficient quantities to prove serious, while the vomiting has been in these same cases quite as severe as in patients anæsthetized in the usual manner. In addition, certain cases have proved quite intractable to the new mode of administration within any reasonable time, and inhalation has been added.

From New York comes the account of a case in which two ounces were administered to a child of eight months, in which bloody discharges and death occurred the following night.

The present experience has been sufficient to formulate the following rules, which should guide any one desirous of using the new method, until further experience modifies them:

Rectal etherization should be reserved for cases in which there is some special objection to the administration by inhalation.

It should be made use of only with robust adults.

In general, two ounces should be regarded as a sufficient dose. That dose should be exceeded only with great caution.

When insensibility is fairly established the administration should be stopped.

MISCELLANEOUS.

DR. MORELL MACKENZIE'S DISEASES OF THE THROAT AND NOSE.—The second volume of this work, which was on the eve of publication, was burned at a fire in a London book-publisher's establishment, and, had not one copy fortunately been in the possession of the author, four years of unremitting labor would have been entirely lost; but the reprint will be carried out by the publishers, Messrs. Pardon, as rapidly as possible, and the volume will, it is hoped, be brought out in three or four months.

RUSSIAN MEDICAL LITERATURE.—Dr. Max Bach, in the *Deutsche Medicinische Wochenschrift*, gives to Russia seventeen medical journals, a few of which are confined to special subjects, such as psychiatry, and neurology, medical jurisprudence, military hygiene, etc. In addition to this, the transactions of several medical societies, and numerous theses, besides independent works and brochures, it may be estimated that nearly a thousand independent medical productions are annually printed in Russia.

THE

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PUBLISHED WEEKLY.

THE EDITOR of this JOURNAL would be glad to receive any items of general interest in regard to local events, or matters that it is desirable to call to the attention of the profession. Letters written for publication or containing items of information, should be accompanied by the writer's full name and address, although not necessarily to be published. All communications in regard to editorial work should be addressed to the Editor.

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SATURDAY, MAY 31, 1884.

MEMBERS BY APPLICATION.—At the last meeting of the National Association action was taken for amending the constitution in such manner as to provide for the admission of members by application, in addition to the previous methods, as may be seen by reference to the minutes as given on page 573 of the present volume of the Journal (No. 21, May 24, 1884). Under the new provision any member of a State, County or local society, recognized by representation in the American Medical Association, who is himself in good standing in the local society to which he belongs, may become a member of the National Association, by making application in writing, and accompanying such application by a certificate of his good standing, signed by the President and Secretary of the Society to which he belongs, and the payment of five dollars membership fee. The amendment adopted does not specify the officer of the Association to whom the written application, certificate of good standing and fee, should be sent. But as the Treasurer is the proper officer to receive all membership dues, and to keep a record of all who retain their membership by continuing to pay the annual fee of five dollars, it would be better if all papers and money relating to applications for membership in the manner specified above, should be sent directly to the Treasurer, Dr. Richard J. Dunglison, Lock Box 1274, Philadelphia, Pa. Members by application will hold the same rank as other permanent members. They will be entitled to receive the Journal of the Association, attend the annual meetings, and retain their membership so long as they continue to pay the annual dues and comply with the regulations and requirements of the Association, but without the right to vote; the latter being reserved for delegates only.

ILLINOIS STATE MEDICAL SOCIETY.—This Society held its thirty-fourth annual meeting in this city, commencing on Tuesday, May 20, 1884, and continuing until Thursday evening following. The attendance was large and the meeting a profitable one. The full report of the proceedings, which had been prepared for this number, must be deferred until the next, on account of the unusual space occupied by the address of the Chairman of the Section on Surgery and Anatomy in the American Medical Association. The reports and papers read were, in most cases, well prepared and appropriate. As everywhere else, the idea of germs as efficient causes of disease, and germicide remedies, pervaded a large part of the papers and discussions; and it was noticeable that some members economized their materials and labors by favoring the State Society with the same matter that had previously been brought fully before the profession through local societies and medical journals. The profession of the city gave the State Society an elegant banquet at the Grand Pacific Hotel on Wednesday evening, which was enjoyed in a high degree by the large number in attendance.

DELEGATES TO THE INTERNATIONAL CONGRESS.—To the list for delegates for the International Medical Congress at Copenhagen and other foreign societies, appointed at the recent meeting of the American Medical Association, and published in the minutes of the meeting in the JOURNAL for May 24, the name of Dr. G. M. B. Maughs, of St. Louis, Mo., should be added.

A PRIZE FOR MORE LIGHT ON THE BACILLUS.—A Fellow of the Linnæan Society, of New South Wales, offers a prize of £100 for the best essay on "The Life-History of the Bacillus of Typhoid Fever." The essays must be written in the English language, and delivered at the Society's office on or before the 31st of December, 1884.

EDUCATIONAL PROGRESS.—The Faculty of the Medical College of Ohio has adopted the rule to subject all applicants for admission to the college, to an examination on their preliminary or general education, except such as present a diploma or other evidence of sufficient literary attainments.

APPOINTMENTS.—Dr. William H. Welch, of New York, has been elected Professor of Pathology in the Johns Hopkins University, Baltimore. Dr. Thomas A. McBride has been elected Professor of Mental and Nervous Diseases in the New York Polyclinic. Sir William Jenner has been re-elected President of the Royal College of Physicians, of London.

DELAWARE STATE MEDICAL SOCIETY.—The ninety-fifth annual meeting of this Society will be held in Wilmington, Delaware, on Tuesday, June 10, 1884, in the lecture-room of Masonic Temple. This is one of the oldest State Medical Societies in the country. Dr. J. A. Draper, of Wilmington, is Chairman of the Committee of Arrangements, and Dr. G. W. Marshall, Milford, Delaware, Secretary.

PAYING A PREMIUM OR A COMMISSION ON MEDICAL STUDENTS.—According to the newspapers, St. Louis has a medical college (Eclectic) which for business enterprise is likely to rival its neighbor of free scholarship fame in Louisville. It offers its agents $12.50 commission for every student who will pay the regular lecture-fee of $75, and $25 as commission for each full scholarship sold at $150. It will take such commissions a long time, however, to overtake free scholarships and skilled letter-writers.

BOOK REVIEWS.

MEDICAL EDUCATION AND THE REGULATION OF THE PRACTICE OF MEDICINE IN THE UNITED STATES AND CANADA. Published by W. T. Keener, Chicago.

This book is a revised and corrected edition of the Fifth Annual Report of the Illinois State Board of Health. The publisher has found it desirable to present it to the general public, as at this time much interest attaches to the subject. The edition at the disposal of the Board of Health was also inadequate to supply the demand.

The material of the book is distributed under the following headings: Schedule of Minimum Requirements Entitling a College to Recognition; Laws Regulating the Practice of Medicine in the United States and Canada; Medical Institutions in the United States and Canada—Extinct and Existing—Including Examining and Licensing Boards; Medical Colleges—Existing; their Organization; Course of Instruction; Requirements for Admission and Graduation; Fees; Number of Students; Percentage of Graduates to Matriculates, etc.; Auxiliary and Post-Graduate Schools; Colleges for Women only; for Both Sexes; for Colored Students; Colleges Conferring Degrees on Summer Sessions; List of Institutions, Extinct and Existing, not Recognized; Summary and Tabular Statements.

FRACTURES OF THE NECK OF THE FEMUR, WITH SPECIAL REFERENCE TO BONY UNION AFTER INTRA-CAPSULAR FRACTURES. By N. SENN, M.D., Milwaukee, Wis. Extracted from the Transactions of the American Surgical Association, Vol. I, 1883. Philadelphia: Collins, Printer, 705 Payne St. 1883.

This is a neatly printed monograph of 113 pages, on good paper, and illustrated by nineteen well executed cuts.

In addition to a full, if not exhaustive examination of what had been done and written concerning fractures of the neck of the femur, the author has added a valuable series of original experiments on animals, chiefly on cats and dogs. These experiments, to the number of thirty-two, were instituted for the purpose of obtaining answers to the following questions: 1. "What is the mode of repair after non-impacted intra-capsular fracture of the neck of the femur? 2. What becomes of a bone or metalic nail when driven into the neck of the femur and retained permanently? 3. What is the effect of such a nail upon the adjacent bone tissue? 4. Can we, in cases of intra-capsular fractures of the neck of the femur, by immediate or direct measures, as by nailing the fragments together, obtain such accurate co-aptation and retention as to secure union by bone?"

The results of these experiments are given in the first fifteen pages of the work, together with the case of a female patient in which complete bony union occurred after an intra-capsular fracture of the neck of the femur. In the first twenty-one experiments on animals, no nails, either of metal or bone, were driven into the fractured part of the neck for the purpose of keeping the fragments more perfectly in apposition, and in none of them did bony union follow. In the remaining experiments the fractures were produced subcutaneously, and the parts subsequently secured in apposition by nails of bone or metal driven into the fragments. And in two of these cases complete bony union resulted: and in several, the nails of bone disappeared entirely by absorption.

The anatomy of the neck of the femur occupies ten pages, following which the author gives a description of the different varieties of fracture liable to occur, both intra and extra-capsular, occupying seventeen pages. The next ten pages are occupied with a consideration of the causes of fractures of the neck of the femur, including senile osteoporosis. After giving a very plain and interesting account of the symptoms and diagnosis of fractures of this part of the bone, the author enters upon the consideration of the production of callus. This is perhaps the most interesting and exhaustive part of the monograph. Having assumed that bony union can take place and in many instances has done so, after true intra-capsular fractures, he enters upon a thorough study of all the more recent investigations on this part of the subject, both in this country and Europe. The last ten pages of the monograph are occupied with a concise statement of the author's views regarding the treatment of the variety of fracture under consider-

ation. The reader will find in the 113 pages of the pamphlet before us, clearly and concisely stated, the results of a most extensive and impartial study of the long controverted questions concerning the results of intra-capsular fractures, to which the author has added much valuable, original matter of his own development.

Dr. Senn is a patient, accurate, and thorough investigator, with the happy faculty of expressing his thoughts in language both concise and elegant. And the present monograph merits a place on the table of every practitioner, whether physician or surgeon.

DOMESTIC CORRESPONDENCE.

Richmond, Ind., May 22, 1884.

CHAIRMEN OF SECTIONS.

At the recent session of the Association there was not time for all the chairmen of the Sections to read, in the general morning meetings, the address the plan of organization requires them to prepare for the occasion, and more than one of the excluded manifested a sharp sense of disappointment. There are now seven Sections, and the programme assigned two of the addresses of chairmen for Wednesday morning, two for Thursday and three for Friday morning. By a misapprehension of the law these addresses are usually an hour long, instead of forty minutes, and as the morning meetings are practically limited to three hours, the days on which two addresses are delivered have two-thirds of the time of meeting consumed by them, and on the day that has three assigned they would occupy the entire time, except it be on Friday when, without Section meetings in the afternoon, the general session may occupy as much of the day as its business requires. But the situation then has this drawback: so many of the members have departed for home or to look after outside affairs that there is left a formidable array of empty seats, which have a depressing influence on the reader of a paper, wherein he has with his best ability incorporated his richest ideas of a year's earnest cultivation in a special line.

True, these unread addresses are to be published the same as if they had been read, but this does not satisfy the chairman who has the reasonable ambition to present his own thoughts in person to his assembled confreres and enjoy the pleasurable inspiration of the moment.

The first four of these addresses, the two on the second day of the session, and the two on the third are usually read, and to audiences respectable in numbers; but those set for delivery on the fourth day have to be referred for publication unread, or delivered to scant and too often inattentive audiences. The situation this year was, therefore, not unlike that of other years. This in nowise, however, lessens the chagrin of those who, this year, were denied the privilege of reading these addresses.

For this disagreeable state of affairs there should be a remedy. What shall it be? We cannot now alter the law regulating this matter, and must seek what relief can be found within its purview. Fortunately this is much; the controlling regulation is this: "The chairmen of the several Sections shall prepare and read in the general sessions of the Association, papers on the *advances* and *discoveries* of the past year in the branches of science included in their respective Sections, the reading of such papers not to occupy longer than *forty* minutes for each." Great relief will come from a strict observance of the forty minutes limitation. Many of these addresses have occupied an hour or more in delivery. Let the committee fix an hour for the reading of the first address, fix the time for a second forty minutes later, and for a third forty minutes after this; give this arrangement the force of a special order and see that it is adhered to. This allots two hours for three papers on Wednesday morning, the time usually consumed by two. The following morning three more of the addresses could be read under like provisions, and this would leave but one to be read on the morning of the last day, for which time could certainly be spared.

Doubtless some chairmen will object to a restriction to forty minutes, but as that is the law under which they took service they should voluntarily conform to it, and if they do not the presiding officer should cut them off, each when his time is out, though his address be not finished, and give his successor his right of a hearing. Proper regulations, judiciously carried out, is the only feasible way of conducting successfully the business of a large assembly of men who have multiple affairs to consider and decide. Moreover there is small doubt that any chairman of a Section who knew in advance that his reading would be limited to forty minutes would prepare his paper to conform to that necessity.

It will be observed that another obligation of the chairman is that his paper to be read before the general session of the association shall be on the advances and discoveries of the past year in the branches of science included in the section of which he is chairman. This obligation is both significant and important and it is deemed safe to say that no chairman can ignore it and give entire satisfaction to the association. It is obvious that in adopting this regulation it was the purpose of the association to secure to itself annually the improving and enjoyable opportunity of listening to an intelligent résumé of a year's progress of medical science in the departments severally confided to the Sections, the presumption being that each chairman would, immediately on his appointment, devote himself to a careful scrutiny of the current literature of his department to be continued through the year and then sum up so much of the most important matter contained in his notes as could be intelligently presented to the association in forty minutes. This presumption has not always been realized, and there were some notable failures at the late session. But it is a fair conclusion that if the doctors who have had the honor of chairmanships conferred on them this year, realize how unsatisfactory were the addresses that did not conform to the law, there will be no failures in this behalf at New Orleans.

J. F. H.

THE ACTIVE AGENT IN JEQUIRITY INFLAMMATION.

Erroneous impressions about the influence of microbes is greatly to be deprecated, and by no one is this more keenly felt than by those who sincerely wish to give the microbe its due influence either for the weal or woe of the human race. It is consequently with regret that we find in the address of the Chairman of the Section of Practical Medicine of the American Medical Association, that the influence of the jequirity is said to be of special importance because "in it we have pressed into our service the ubiquitious microbe, which is receiving at present so much attention." See address Vol. I, No. 19, p. 517. This position taken by Sattler, and supported by Cornil and Berlioz, has been so completely overthrown by Neisser, of Berlin, and Salomonsen and Dirckinck-Holmfeld, of Copenhagen, and the question itself is of such intrinsic interest, that whilst the matter is fresh before the minds of the profession, we venture to offer to the JOURNAL an abstract of these critiques on Sattler's work, which we published in *Weekly Medical Review* of April 5.

The examination of Sattler's work was undertaken both in Breslau and in Copenhagen. In both cases the results furnished conclusions absolutely different from those advanced by Sattler. Dr. Neisser, who conducted the experiments made in Breslau, claims that the statement that inflammation is due to bacteria is not yet proven, and that the claims of Sattler do not correspond to the facts. If, says he, the inflammation is due to bacteria, then must the following conditions hold: 1. There must be a distinct species of bacteria in the infusion. 2. Without bacteria the infusion will be inactive. 3. The bacteria of pure culture should at least have the same activity as the fluid containing the bacteria. 4. In the pathological product developed, conjunctival secretion and exudate, the infecting entity should be found and then when transferred to the conjunctiva of another animal the same affection should be developed.

As a matter of fact relative to the first condition, there does exist in the infusion, as usually employed, a well-marked form of bacteria, which flourishes so abundantly that other forms are altogether in abeyance; but that the specific action of the infusion is to be attributed to this bacillus, after repeated and varied experiments Dr. N. positively denies. He thus formulates the results of his observations: 1. An infusion which is free from bacteria exhibits the same activity as that which contains bacteria. The infusion was made so as to be free from bacteria, by the rigid observations well known to those acquainted with that kind of work. So long as the infusion was kept free from bacteria it remained active, but lost its activity after the development of the bacteria. 2. The use of the bacilli of pure culture, in order to produce the characteristic ophthalmia, was powerless. The bacilli were introduced into the conjunctiva in large quantities, and often without any characteristic results. 3. I have never found in the secretions from the eyes affected with the jequirity inflammation, nor in the diphtheritic membranes, any evidence of the bacillus. Micrococci I have found, but the characteristic bacillus, never. 4. The application of the ophthalmic secretion to an eye not affected, produces no inflammatory action. Dr. N. believes that the peculiar action is due to a substance existing in the bean, which the chemists who have hitherto investigated the question have not been able to isolate—an amorphous ferment.

The subject is also taken up at length, and published in the same number of the *Fortschritte der Medicin*, from which we have extracted the above, by Dr. C. J. Salamonsen and M. Dirckinck-Holmfeld, in Copenhagen. Here observers also found that an infusion made with all due precautions, remains perfectly clear and active practically indefinitely, as long as the bacteria are prevented from disturbing its influence.

On the question of the existence of bacilli in the secretions and exudations, they say: We could not find, either in the pus or in the diphtheritic layer from the conjunctiva, when examined under the microscope, any bacillus. Sometimes we found micrococci in the secretions. The membranes and pus, moreover, were taken from the eyes, and an effort made to cultivate any special bacillus which might be present; but though certain forms of bacteria developed, the special form which dominates in the infusion under favorable circumstances, never presented itself.

Pus was also taken by these observers from the afflicted eyes, and an effort made to excite a similar affection in a healthy eye, but without producing anything more than the faintest conjunctivitis.

The characteristic bacilli of pure culture were, without any effect, rubbed into the conjunctiva also by these observers, and their conclusion naturally was, that the effect was due to a special proximate principle existing in the jequirity bean; and their further efforts were directed to establish their belief, or convince them of their error.

Their observations showed them that the active principle was insoluble in alcohol, chloroform, benzine and ether; that it was comparatively slightly soluble in water, but very soluble in glycerine. They were unable to extract any alkaloid, and expected the presence of an amorphous ferment. To establish this point, the jequirity seeds having been ground up, the powder was treated with ten times its weight of pure glycerine, rubbed up well and allowed to stand for twenty-four hours, filtered, and then precipitated with five times its volume of alcohol. This precipitate was again treated with the necessary means for purification, and the result, dissolved in both water and glycerine, gave the characteristic jequirity inflammation.

The smallness of the amount of the active principle necessary to produce the inflammation is very striking. The glycerine solution which corresponded to the one hundred-thousandth part of a gramme, developed the characteristic inflammation, but one-half the quantity produced no effect.

These two investigators thus sum up the result of their observations:

1. The jequirity inflammation is not the result of bacteria.

2. It is the result of an active principle in the seed, soluble in both water and glycerine, but insoluble in alcohol, chloroform, ether and benzine; and destroyed by a temperature of from 65° to 70° C., if sustained for an hour.

3. The quantity of the active principle contained in the one hundred-thousandth gramme of jequirity seed develops a well marked conjunctivitis. The poison, when injected subcutaneously in mice or frogs, quickly kills.

We have given this much space to this question because of its intrinsic interest. It is not likely that a substance as active will, in these days of rigid investigation, be confined to observation on trachomatous eyes. The investigators above referred to have not yet given a name to the amorphous substance which they extracted, but as we are likely to hear from them again on this subject, we have no doubt they will suggest some appropriate appellation. The bacillus, in this case at any rate, has to take a back seat.

R. TILLEY, M.D.

Chicago.

FROM WASHINGTON.

MATTERS OF MEDICAL INTEREST BEFORE CONGRESS.

May 9.—The bill (S. 1,044) to establish a University of original research and of medicine, as a part of the Smithsonian Institute, for the advancement of science and the discovery of improved methods of treatment and cure of disease, was brought up before the Senate by Mr. Call, of Florida. The bill is about the same in text as already referred to here, but now it is proposed to connect it with the Smithsonian Institute. Mr. Call made his speech, which was a long one, and, as he says, expressed the thoughts of others upon pretty much the whole range of scientific research that medicine could possibly embrace. The bill was not discussed, nor has there as yet been any disposition made of it.

May 12.—The petition of the American Medical Association, praying that proper provision be made for the prevention of epidemic diseases in the United States, was presented in the Senate, and referred to the Committee on Epidemic Diseases. The petition was presented in the House on May 14, and similarly referred.

May 14.—To the resolution directing the public printer to publish extra copies of the *Medical and Surgical History of the War of the Rebellion*, etc., the text of which is given on p. 529, was added "or for the volumes already published, or to be published hereafter, of the Index Catalogue of the Library of the Surgeon General's Office." This was agreed to, and the further statement made by Mr. Hawley that the public printer will undoubtedly prepare a little circular, or brief statement, giving the price, so that those who wish to obtain these documents have only to write to the public printer, and, on ascertaining the price, which to them will be 10 per cent. above the cost of paper and press-work, send the money with the order, and wait until an edition is struck off. There is, I believe, no fixed price for the *Medical and Surgical History*, which is sold here by second-hand book-dealers at $5.00 per volume. The Index Catalogue is valued at $2.00 per volume.

NECROLOGY.

BEALE, JAMES SHEILDS, M.D., of Washington City, was born in this city November 14, 1841; died suddenly of apoplexy, in the parlor of Providence Hospital, February 12, 1884, where he had gone to perform an important operation.

He was the son of Robert Beale, and was born in the old Read mansion, corner of B. and Pa. Ave., S. E. The doctor left college without the knowledge of his parents, and joined the Confederate Army at the outbreak of the war between the States. On the restoration of peace, he studied medicine, and graduated M.D. from the Medical Department of the University of Georgetown in 1859. Afterward he visited Europe, and took special courses in Paris, London and Vienna. Returning to Washington, he opened an office in the house where he was born, and speedily acquired a good practice. His preference was for surgery, and at the time of his death he was ranked among the leading surgeons of the city. Besides a large private practice, he was on the surgical staff of Providence Hospital, and had been connected with that institution for over ten years. He filled the chair of Anatomy of the Medical Department of the University of Georgetown from 1876 to 1883, when he resigned. He was a trustee and a member of the teaching Faculty in the "Washington Training-School for Nurses." He was a member of the Medical Society of the District of Columbia, of the Medical Association of the D. C., and the Gynæcological Society of Washington. These bodies held meetings and passed appropriate resolutions of regret, as did the staff of Providence Hospital and the students of the medical department of Georgetown University. Dr. Beale occasionally read papers before the Medical Society of the D. C., and contributed papers to medical journals. He was a man of cultivated manners, of sympathetic disposition, and untiring in his efforts to benefit his patients, and they were devotedly attached to him.

The doctor leaves a widow and three children. His funeral took place from Ascension church, the Rev. Dr. Elliot officiating. His remains were placed to rest in "Oak Hill cemetery." The funeral was attended by a large number of physicians and a great concourse of friends.

J. M. T.

JEROME, JAMES H., M.D., of Saginaw City, Michigan, was born at Cochecton, Wayne county, Pa., Sept. 28, 1812, died at his residence in Saginaw Aug. 8, 1883. His parents removed to Michigan when he was a lad about 15 years of age, and his father died three years later. He attended a district school, and had one year's tuition at the Ovid Academy. The limited means of the family compelled the youth to largely rely upon his own resources. He

learned the trade of a hatter, serving an apprenticeship, and followed the business until 1834. A fondness for study led him to a desire for a still higher education. After giving some time to the study of Latin he began reading medicine with Dr. Moses Tompkins, near Hector, N. Y. He attended the Geneva Medical College in the winter of 1834–5, and while there was fortunate enough to attract the attention and secure the friendship of Willard Parker, Professor of Anatomy and Physiology. He then attended a course of lectures at Pittsfield, Mass. At the invitation of Dr. Parker he returned to Geneva, and acted as his assistant in preparing cases for illustration in the lecture-room. Dr. Jerome graduated from Geneva Medical College in 1837. Immediately after obtaining his degree he began practice at Trumansburg, N. Y., where he speedily acquired business and held positions responsible in medical societies.

In 1855 he received the Honorary Degree of M.D. from Hobart Medical College, and in the same year was elected Professor of Anatomy and Physiology to his *alma mater*. In 1858 he was appointed Physician-in-Chief of the Marine Hospital at the port of New York. He then retired from the chair in Geneva Medical College and entered upon his duties in the Marine Hospital in 1859, but shortly afterward resigned in consequence of difference of opinion with the Commissioners of Immigration, and returned to his former field of labor at Trumansburg. In 1839 he was married to Lizette Atwater, of Perry, N. Y. Eight children blessed this union. Mrs. Jerome died in July 30, 1863. In 1865 Dr. Jerome removed to Saginaw, Mich., and married Calista Allen. In his new home he engaged extensively in manufacturing lumber, but never lost his interest in the healing art. In 1866 Jerome assisted in organizing the Michigan State Medical Society, and was always earnest in his support of regular medicine. He was a member of the Board of Councillors of Detroit Medical College, and its President from its organization. The Board passed appreciative resolutions after his death. The physicians who attended his funeral also joined in a series of resolutions of respect for his memory, which have been published in the Association journal of August 1883, p. 223. (From notes furnished by W. F. Breakey, M.D., of Ann Arbor). J. M. T.

MISCELLANEOUS.

NEW BOOKS.

Le Gendre, P. Contribution au diagnostic du chancre syphilitique de l'amygdale. 8vo., 344 pp. Paris: Davy.

Leroy, C. J. A. De la kératoscopil, on de la forme de la surface cornéenne déduite des images apparentes réfléchies par elle. 8vo , 15 pp., avec., 7 fig. Paris: Davy

Maigret, M. J. De la créosote en thérapeutiqul. Injections sous-cutanées de peptone créosotée. 8vo., 47 pp. Paris: Davy.

Millet, J. Des vertiges chez les aliénés. 8vo , 31 pp. Paris: Boudet.

Moncorvo. Traitement du spina-bifida par les injections iodoglycérinées. 8vo , 19 pp. Paris: Davy.

Moreau-Marmont. Memoire sur l'hémorrhagie consécutive à l'extraction des dents. 8vo., 40 pp. Louis: Bousrez.

Renault, P. Lésions congénitales et acquises du cœur, rétrécissement congénital des orifices artériels, persistance du trou de Botal, lésions mitrales, pas de cyanose. 8vo , 11 pp , avec 2 fig Paris: Davy.

Reverchon, A. Contribution à l'étude de l'atrophie musculaire progressive, typeorau, Duchenne. 8vo., 42 pp. Paris: Davy.

Ruyssen, G. C. A. De l'ergotine dans le diabète sucré. 8vo., 36 pp. Paris: Davy.

Sénac-Lagrange. De la nature des dyspepsies et de leurs conditions vitales dévoilées par les eaux sulfureuses, notamment les eaux sulfureuses de Cauterets. 8vo., 23 pp. Paris: Hennuyer.

Ebstein, Wilhelm. Corpulence and its Treatment on Physiological Principles; translated and adapted for popular reading by Emil W. Hœber, M D. 4to, 51 pp. New York: Breutano Bros. Paper, 50c.

Ranney, Ambrose L. The Topographical Relations of the Female Pelvic Organs. 8vo, 121 pp. New York: W. Wood & Co. Cloth, 75c.

Tait, Lawson. The Pathology and Treatment of Diseases of the Ovaries; being the Hastings essay for 1873. 4th edit., re-written and enlarged. 8vo, 357 pp. New York: W. Wood & Co. Cloth, $3.50.

OFFICIAL LIST OF CHANGES IN THE STATIONS AND DUTIES OF OFFICERS SERVING IN THE MEDICAL DEPARTMENT UNITED STATES ARMY, FROM MAY 17, 1884, TO MAY 23, 1884.

Sternberg, Geo. M., Major and Surgeon, relieved from duty in the Department of the East and ordered to report to the Surgeon-General of the army for temporary duty. (Par. 2, S. O. 115, A. G. O., May 17, 1884.)

Magruder, David L., Lieut.-Colonel and Surgeon, ordered to be relieved from duty as medical director, Department of the Missouri, and to proceed to Philadelphia, Penn., and assume duties of attending surgeon and examiner of recruits in that city

Fryer, Blencowe E., Major and Surgeon. From Department of Missouri to Department of Dakota.

Ewen, Clarence, Captain and Assistant-Surgeon. From Department of Missouri to Department of Platte.

Strong, Norton, 1st Lieut. and Assistant-Surgeon. From Department of Platte to Department of Missouri. (Par. 7, S. O. 115, A. G. O , May 17, 1884.)

Wilson, George F., 1st Lieut. and Assistant-Surgeon, ordered to proceed to Fort Canby, W. T., for temporary duty at that post, relieving Assistant-Surgeon, W. O. Owen, Jr., U. S. A., who will report in person at these headquarters for further orders. (Par. 5, S. O. 62, Hdqrs. Dept. of Columbia, May 12, 1884.)

LIST OF CHANGES IN THE STATIONS OF MEDICAL OFFICERS, U. S. NAVY, FOR THE WEEK ENDING MAY 24, 1884.

Assistant-Surgeon W. Martin, ordered to U. S. Str. "Constellation."

Medical Inspector H. C Nelson, granted leave of absence for one year.

P. A. Surgeon L. B. Baldwin, detached from U. S. Str. "Pensacola," and "waiting orders."

Surgeon H. M. Wells, ordered to Naval Hospital, Brooklyn.

P. A. Surgeon J. M. Murray, detached from U. S. Str. "Minnesota," and ordered to U. S. Str. "Passaic."

P. A. Surgeon J. R. Waggener, ordered to U. S. Str. "Hartford."

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